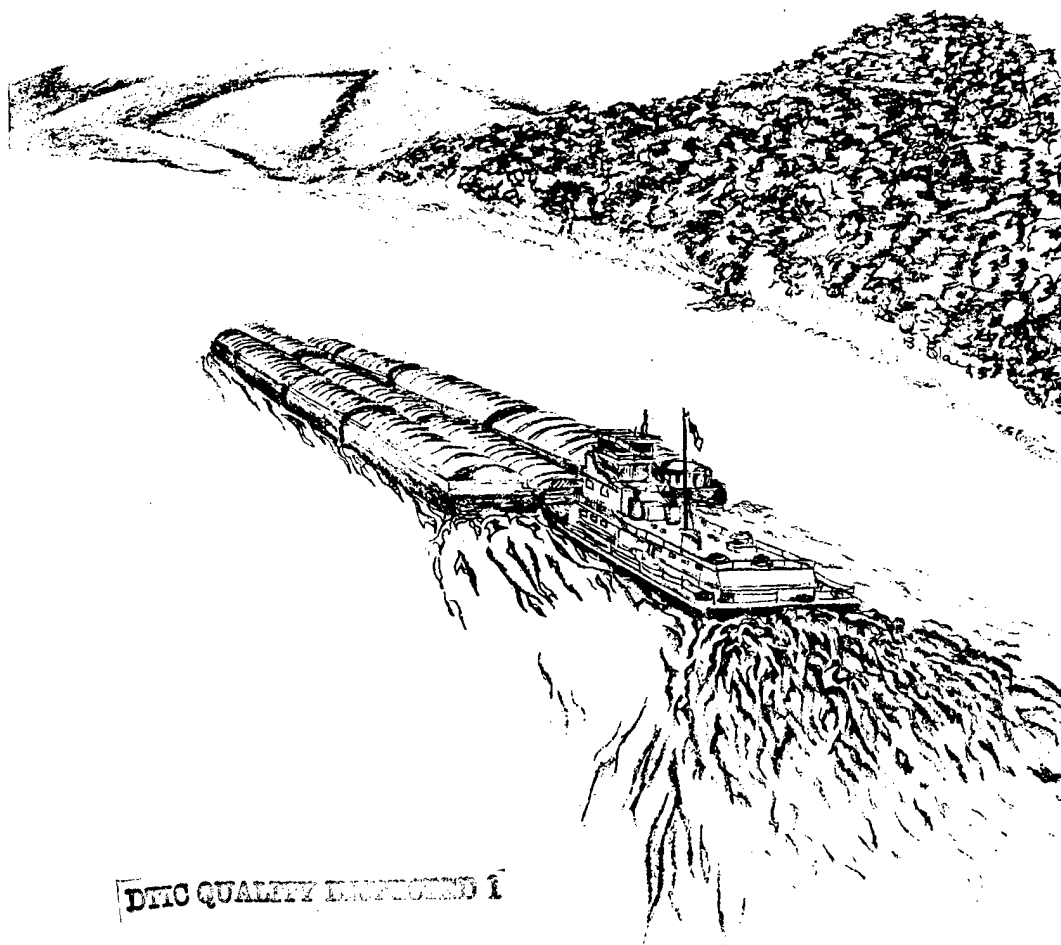


Long Term Resource Monitoring Program

Special Report

98-S001A

Physical Changes Associated with Navigation Traffic on the Illinois and Upper Mississippi Rivers (Appendices)



DMC QUALITY IMPROVEMENT 1

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July 1998

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**PHYSICAL CHANGES ASSOCIATED
WITH NAVIGATION TRAFFIC ON THE
ILLINOIS AND UPPER MISSISSIPPI RIVERS
(APPENDICES)**

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July 1998

Preface

The Long Term Resource Monitoring Program (LTRMP) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662) as an element of the U.S. Army Corps of Engineers' Environmental Management Program. The LTRMP is being implemented by the Environmental Management Technical Center, a U.S. Geological Survey science center, in cooperation with the five Upper Mississippi River System (UMRS) States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin. The U.S. Army Corps of Engineers provides guidance and has overall Program responsibility. The mode of operation and respective roles of the agencies are outlined in a 1988 Memorandum of Agreement.

The UMRS encompasses the commercially navigable reaches of the Upper Mississippi River, as well as the Illinois River and navigable portions of the Kaskaskia, Black, St. Croix, and Minnesota Rivers. Congress has declared the UMRS to be both a nationally significant ecosystem and a nationally significant commercial navigation system. The mission of the LTRMP is to provide decision makers with information for maintaining the UMRS as a sustainable large river ecosystem given its multiple-use character. The long-term goals of the Program are to understand the system, determine resource trends and effects, develop management alternatives, manage information, and develop useful products.

This report was prepared under Strategy 1.2.2, *Determine Effects of Navigation on Selected Components and Processes of the Upper Mississippi River System Ecosystem*, of the Operating Plan¹ (U.S. Fish and Wildlife Service 1993). This report was developed with partial funding provided by the Long Term Resource Monitoring Program. The appendices are part two (98-S001A) of the two-part set of this report. Part one (98-S001) is the initial distribution of the report and part two is available on request.

Suggested citation:

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Additional copies of this report may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 (1-800-553-6847 or 703-487-4650). Also available to registered users from the Defense Technical Information Center, Attn: Help Desk, 8725 Kingman Road, Suite 0944, Fort Belvoir, VA 22060-6218 (1-800-225-3842 or 703-767-9050).

¹U.S. Fish and Wildlife Service. 1993. Operating Plan for the Upper Mississippi River System Long Term Resource Monitoring Program. Environmental Management Technical Center, Onalaska, Wisconsin, Revised September 1993. EMTC 91-P002R. 179 pp. (NTIS #PB94-160199)

Table of Contents

	Page
Appendix I. Water Surface Slopes at All Study Sites	I-1
Appendix II. Study Site Location and Relative Positions of Various Measuring Sensors	II-1
Appendix III. Bed Material Characteristics and Location of the Bed Material Sampling at All Study Sites	III-1
Appendix IV. Ambient Water Levels and Air and Water Temperatures at All the Study Sites	IV-1
Appendix V. Measured Water Discharge, Computed Average Velocity, and Water Depth for All the Study Sites	V-1
Appendix VI. Ambient Suspended Sediment Concentration at All Study Sites.....	VI-1
Appendix VII. Traffic Characteristics Collected at All Study Sites.....	VII-1
Appendix VIII. Recreational Traffic Characteristics	VIII-1
Appendix IX. Wind Speed and Direction at All Study Sites	IX-1
Appendix X. Date and Time of Passage of Barge Tows and Mean Ambient Velocities before Barge-Tow Passage for All Study Sites.....	X-1
Appendix XI. Induced Velocities at all Sites and all Metering Locations during Barge-Tow Passage.....	XI-1
Appendix XII. Maximum Wave Height and Drawdown at All Study Sites and Also for All Barge-Tow Events.....	XII-1
Appendix XIII. Suspended Sediment Concentrations Data for McEver's Island	XIII-1
Appendix XIV. Suspended Sediment Concentrations Data for Apple River Island	XIV-1
Appendix XV. Suspended Sediment Concentrations Data for Goose Island Site, Trip 1.....	XV-1

	Page
Appendix XVI.	Suspended Sediment Concentrations Data for Kampsville Site, Trip 1 XVI-1
Appendix XVII.	Suspended Sediment Concentrations Data for Clarks Ferry Site, Trip 1..... XVII-1
Appendix XVIII.	Suspended Sediment Concentrations Data for Goose Island Site, Trip 2.....XVIII-1
Appendix XIX.	Database Organization for All Study Sites XIX-1
Appendix XX.	Sample Plots of Altered Velocity Regimes Due to Movement of Navigation TrafficXX-1
Appendix XXI.	Histograms of Maximum Return Velocities within Various Zones for All Study Sites..... XXI-1
Appendix XXII.	Sample Plots of Waves and Drawdowns Generated by the Navigation Traffic XXII-1
Appendix XXIII.	Histograms of Maximum Wave Heights.....XXIII-1
Appendix XXIV.	Histograms of Maximum Drawdown..... XXIV-1
Appendix XXV.	Typical Plots of Suspended Sediment Concentrations versus TimeXXV-1
Appendix XXVI.	Histograms of Suspended Sediment Concentration XXVI-1
Appendix XXVII.	Ratio of Peak to Average Suspended Sediment Concentration Due to Movement of Navigation Traffic ... XXVII-1
Appendix XXVIII.	Comparison of Turbidity and Suspended Sediment Concentration at McEver's Island.....XXVIII-1
Appendix XXIX.	Suspended Sediment Particle Size Distribution XXIX-1
Appendix XXX.	A Predictive Method for Maximum Return VelocityXXX-1
Appendix XXXI.	Technical Papers Published by Water Survey Researchers in Refereed Journals..... XXXI-1
Appendix XXXII.	List of Relevant Technical Reports and Presentations Prepared by Water Survey Researchers XXXII-1

APPENDIX I.

WATER SURFACE SLOPES AT ALL STUDY SITES

McEver's Island Site

<i>Date measured</i>	<i>Average stage at RM 54.9, ft</i>	<i>Average stage at RM 43.1, ft</i>	<i>Water surface slope, ft/mi</i>
5/16/89	420.44	420.01	0.036
5/17/89	420.30	419.92	0.032
5/18/89	420.59	420.20	0.033

Average slope = 0.034 ft/mile

Kampsville Site Trip 1

<i>Date measured</i>	<i>Average elevation at RM 43.1, ft</i>	<i>Average elevation at RM 21.6, ft</i>	<i>Water surface slope, ft/mi</i>
10/09/90	419.85	419.27	0.026
10/10/90	420.50	419.58	0.042
10/11/90	421.30	419.70	0.073
10/12/90	421.80	420.05	0.080
10/13/90	422.60	420.35	0.102
10/14/90	422.80	420.39	0.110
10/15/90	422.90	420.40	0.114
10/16/90	423.00	420.50	0.114
10/17/90	424.25	420.57	0.167
10/18/90	423.25	420.41	0.129

Average slope = 0.096 ft/mile

Trip 2

<i>Date measured</i>	<i>Average elevation at RM 43.1, ft</i>	<i>Average elevation at RM 21.6, ft</i>	<i>Water surface slope, ft/mi</i>
8/12/91	420.20	419.50	0.032
8/13/91	420.30	419.70	0.027
8/14/91	420.40	419.70	0.032
8/15/91	420.00	419.70	0.014
8/16/91	419.90	419.50	0.018

Average slope = 0.025 ft/mile

Apple River Island Site

<i>Date measured</i>	<i>Average stage at RM 552.9, ft</i>	<i>Average stage at RM 522.5, ft</i>	<i>Water surface slope, ft/mi</i>
5/15/90	587.85	583.06	0.158
5/16/90	588.28	583.13	0.169
5/17/90	588.56	583.27	0.174
5/18/90	588.72	583.35	0.177
5/19/90	588.77	583.26	0.181
5/20/90	588.85	582.11	0.222
5/21/90	589.07	582.82	0.206
5/22/90	589.33	582.78	0.216
5/23/90	589.59	582.94	0.219
5/24/90	589.87	583.03	0.225

Average slope = 0.195 ft/mile

Goose Island Site Trip 1

<i>Date measured</i>	<i>Average stage at RM 324.9, ft</i>	<i>Average stage at RM 301.2, ft</i>	<i>Water surface slope, ft/mi</i>
8/20/90	465.08	459.35	0.242
8/21/90	466.52	459.63	0.291
8/22/90	467.99	459.63	0.353
8/23/90	468.59	459.70	0.375
8/24/90	468.38	459.52	0.374
8/25/90	468.23	459.46	0.370
8/26/90	468.29	459.49	0.371
8/27/90	468.92	459.72	0.388
8/28/90	469.57	459.65	0.419
8/29/90	470.21	459.60	0.448

Average slope = 0.363 ft/mile

**Goose Island Site
Trip 2**

<i>Date measured</i>	<i>Average stage at RM 324.9, ft</i>	<i>Average stage at RM 301.2, ft</i>	<i>Water surface slope, ft/mi</i>
7/15/91	466.78	459.47	0.308
7/16/91	466.92	459.57	0.310
7/17/91	466.96	459.59	0.311
7/18/91	466.81	459.35	0.315
7/19/91	466.39	459.29	0.300
7/20/91	466.19	459.46	0.284
7/21/91	465.84	459.44	0.270
7/22/91	465.55	459.41	0.259
7/23/91	465.52	459.49	0.254
7/24/91	465.81	459.75	0.256
7/25/91	466.21	459.71	0.274

Average slope = 0.286 ft/mile

**Clarks Ferry Site
Trip 1**

<i>Date measured</i>	<i>Average elevation at RM 473.75</i>	<i>Average elevation at RM 468.2</i>	<i>Water surface slope, ft/mi</i>
5/17/91	550.69	548.83	0.335
5/19/91	551.14	549.35	0.322
5/20/91	551.37	549.47	0.342
5/21/91	551.47	549.61	0.335
5/22/91	551.47	549.64	0.329

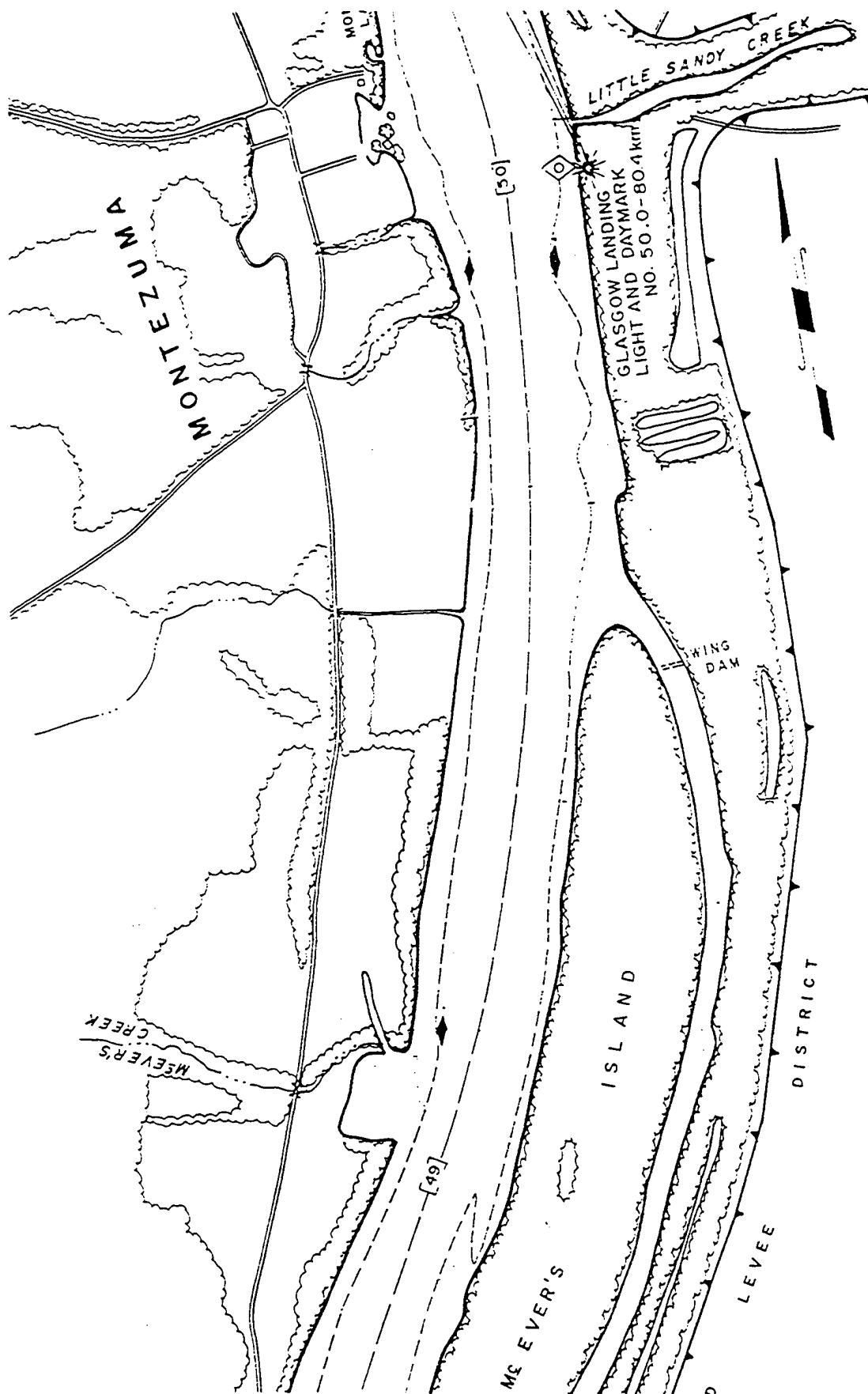
Average slope = 0.333 ft/mile

Trip 2

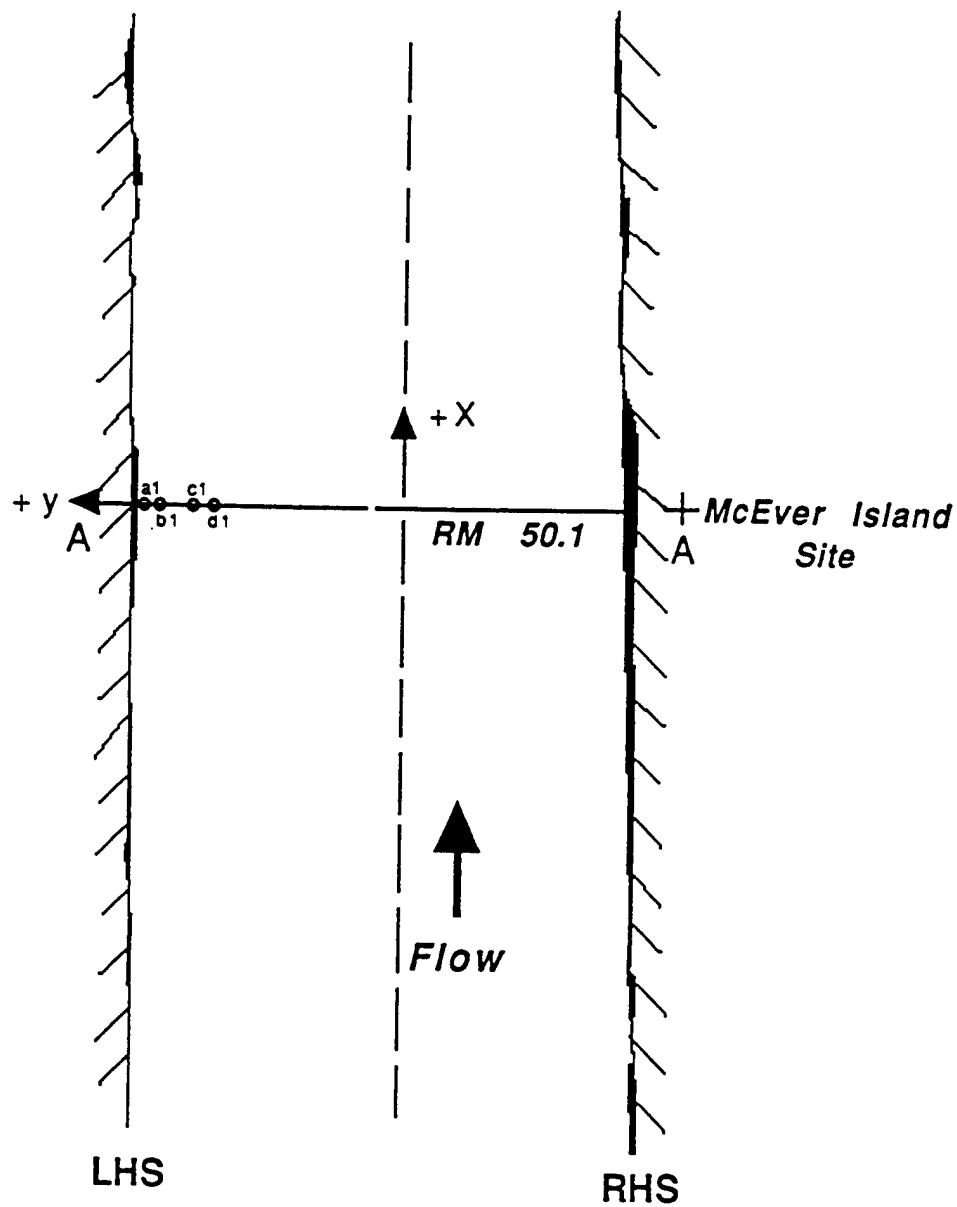
The average surface slope during this trip was 0.06 ft/mile.

APPENDIX II.

**STUDY SITE LOCATIONS AND RELATIVE POSITIONS
OF MEASURING SENSORS**

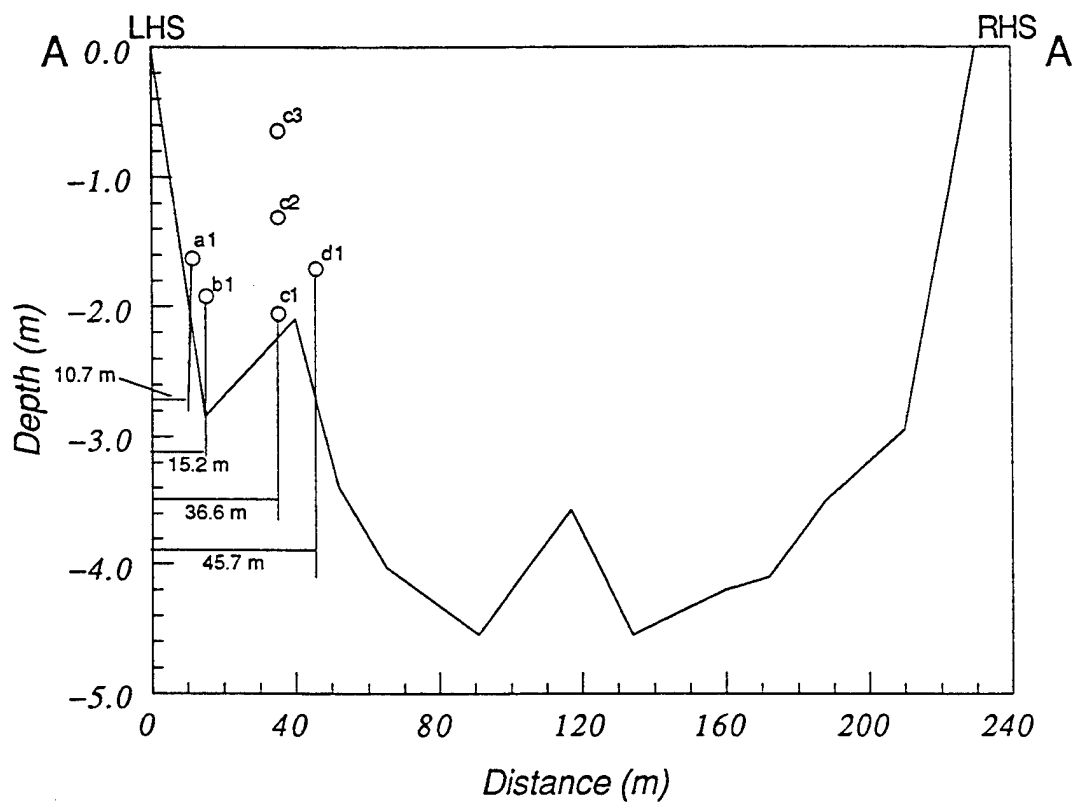


II-1. McEver's Island site on the Illinois River

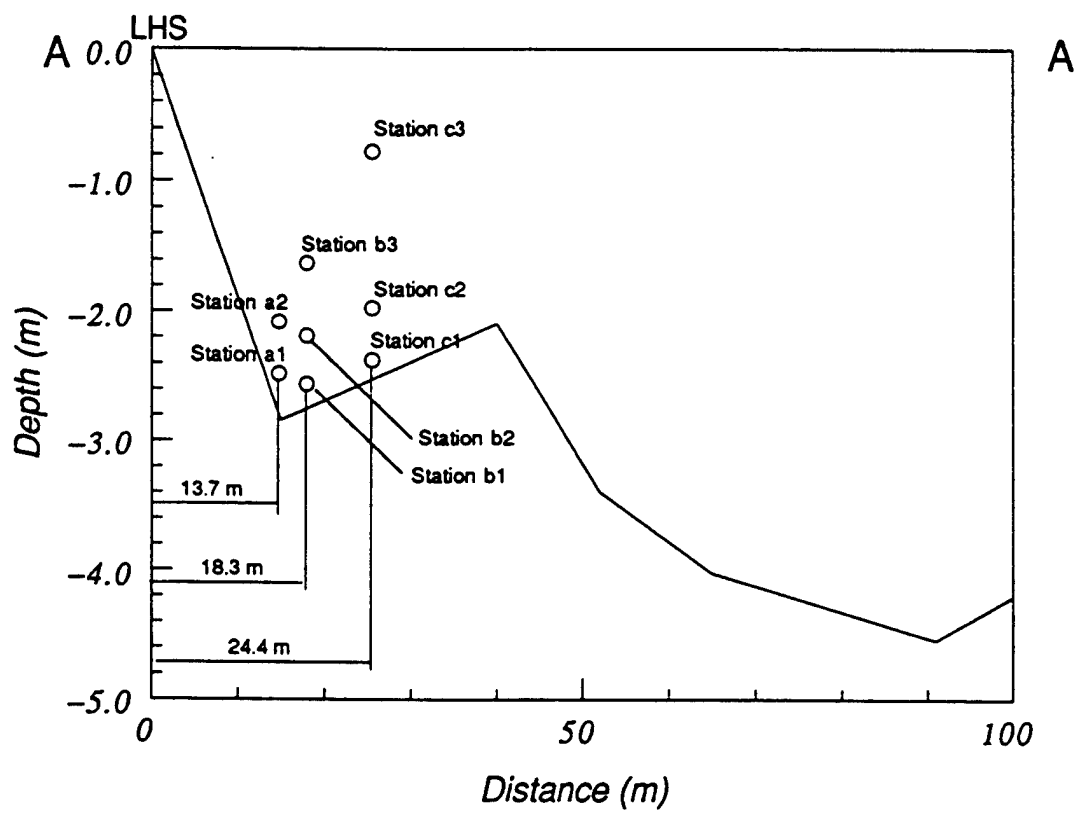


- a1 - MMB511/998, 0.15 m above river bed
- b1 - MMB527/642, 0.91 m above river bed
- c1 - MMB511/999, 0.15 m above river bed
- c2 - MMB511/1000, 0.91 m above river bed
- c3 - MMB511/1001, 2.65 m above river bed
- d1 - S4/071, 0.91 m above river bed

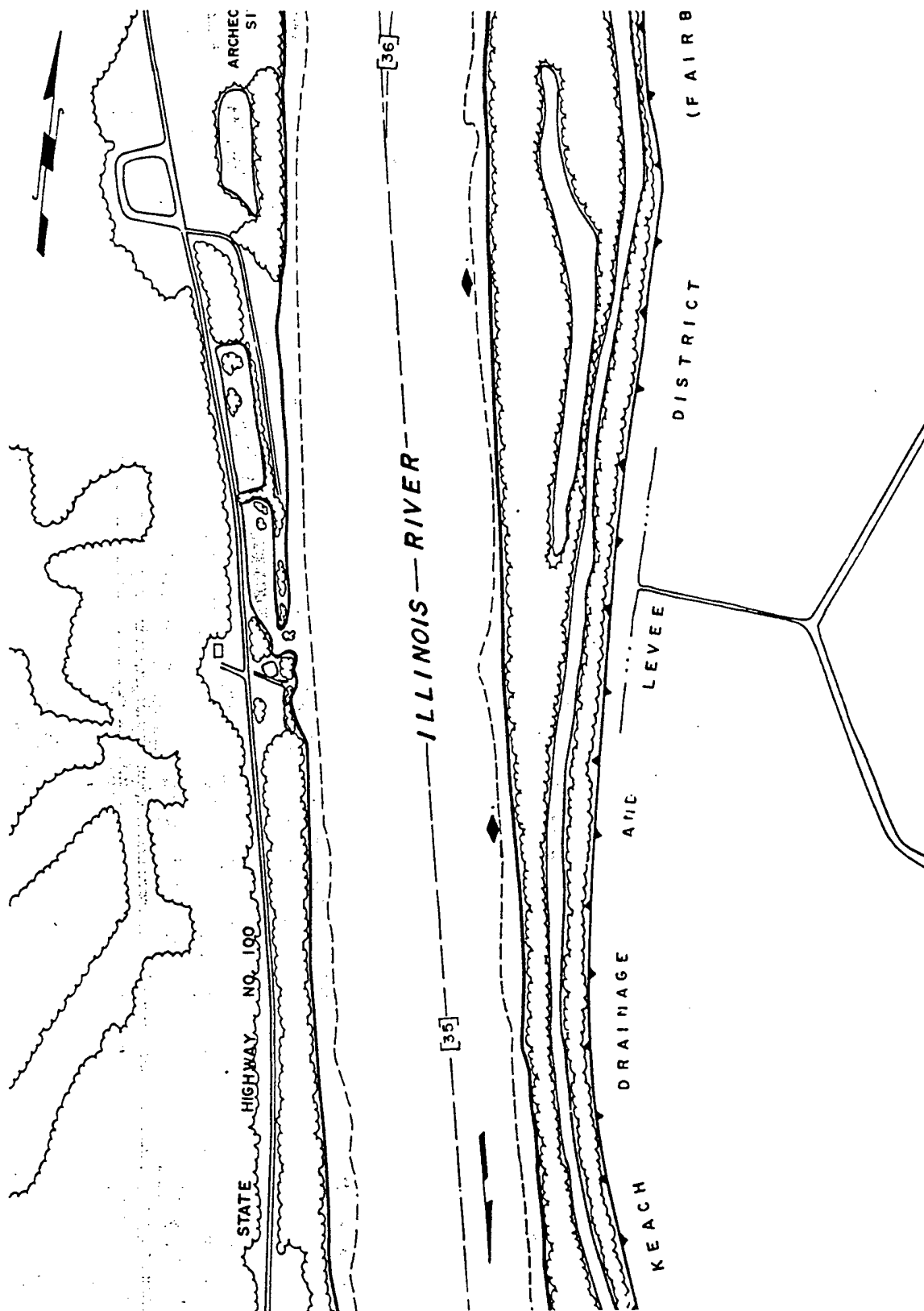
II-2. Plan view of the McEver's Island site
and locations of current meters



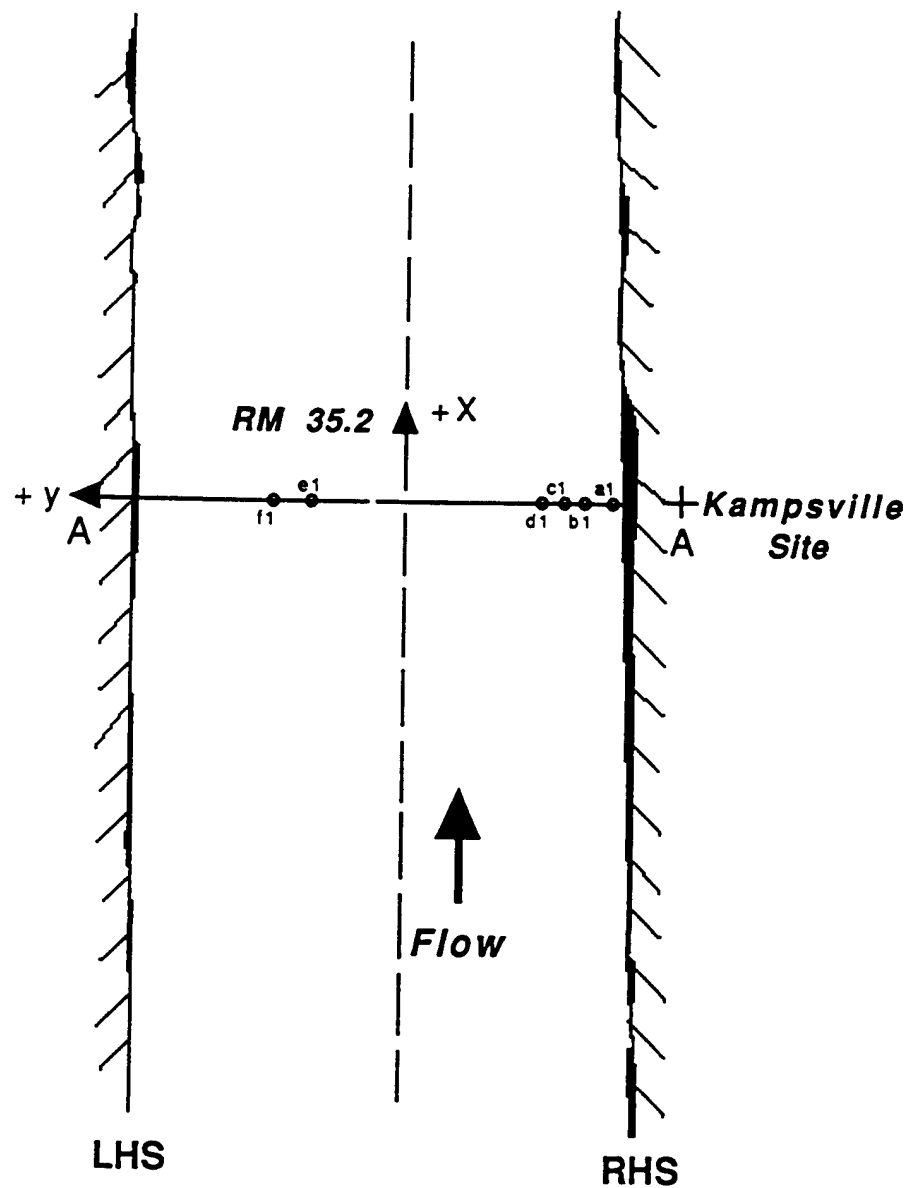
II-3. Cross section of the Illinois River at the McEver's Island site and relative position of the current meters



II-4. Location of suspended sediment sampling stations on the Illinois River near the McEver's Island site

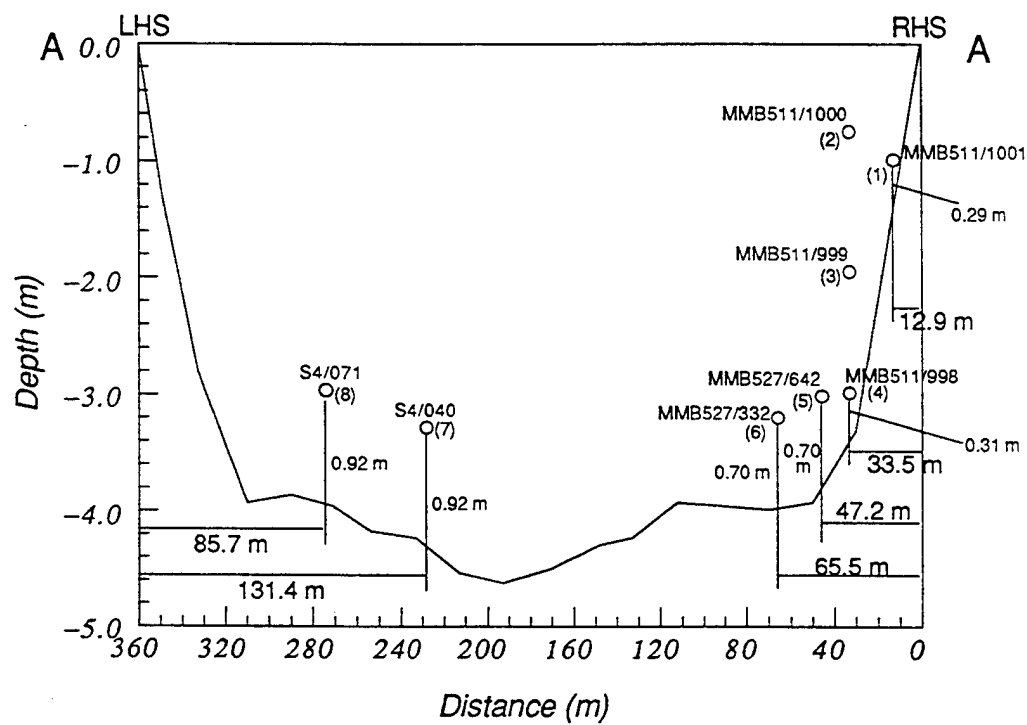


II-5. Kampsville site on the Illinois River

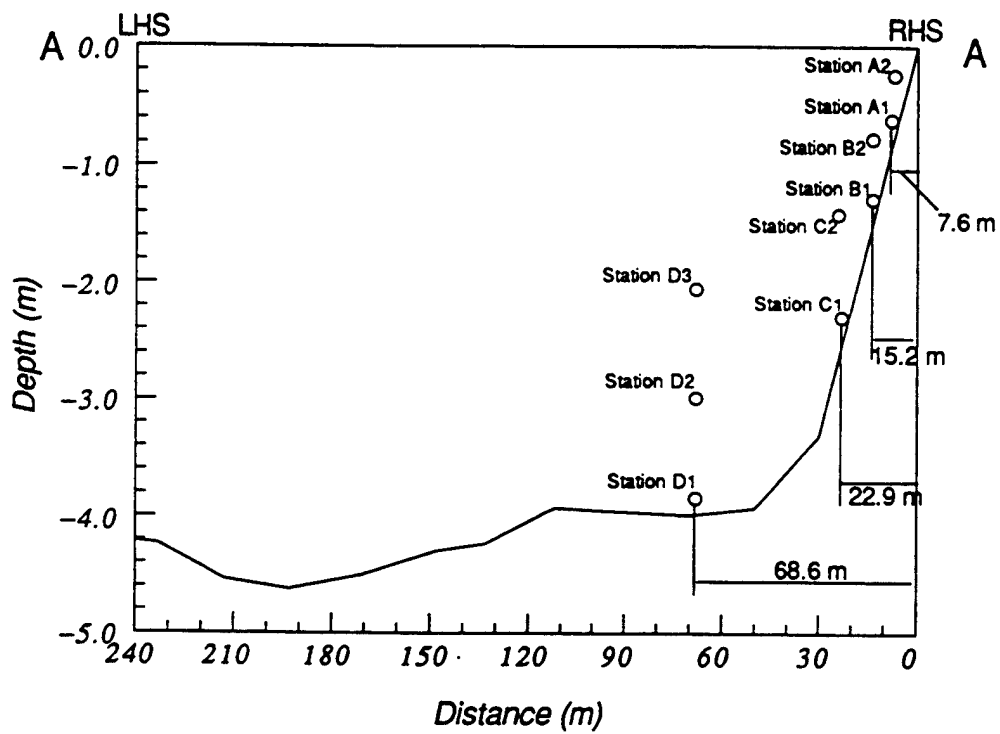


- a1 - MMB511/1001, 0.29 m above river bed
- b1 - MMB511/998, 0.31 m above river bed
- b2 - MMB511/999, 1.22 m above river bed
- b3 - MMB511/1000, 2.44 m above river bed
- c1 - MMB527/642, 0.70 m above river bed
- d1 - MMB527/332, 0.70 m above river bed
- e1 - S4/040, 0.92 m above river bed
- f1 - S4/071, 0.92 m above river bed

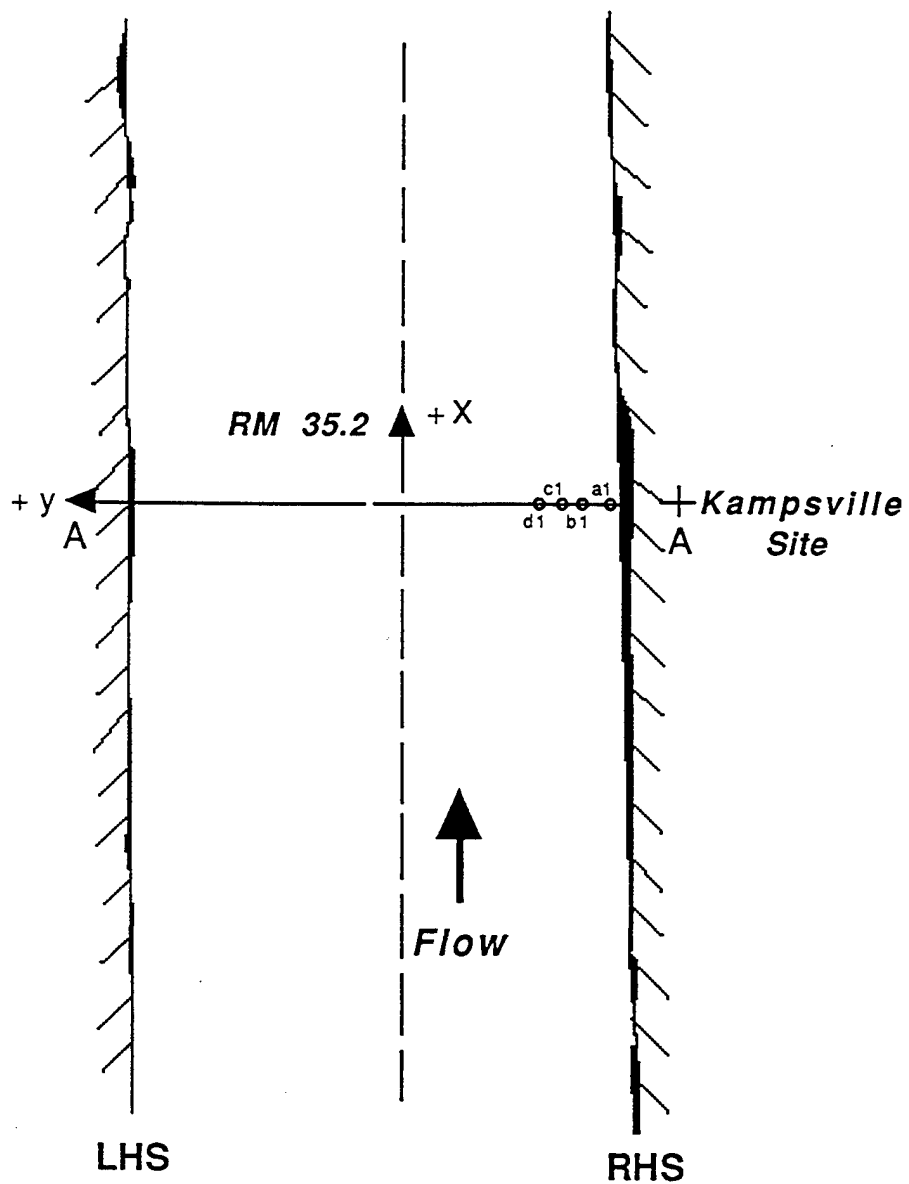
II-6. Plan view of the Kampsville site for trip 1
and locations of current meters



II-7. Cross section of the Illinois River at the Kampsville site for trip 1

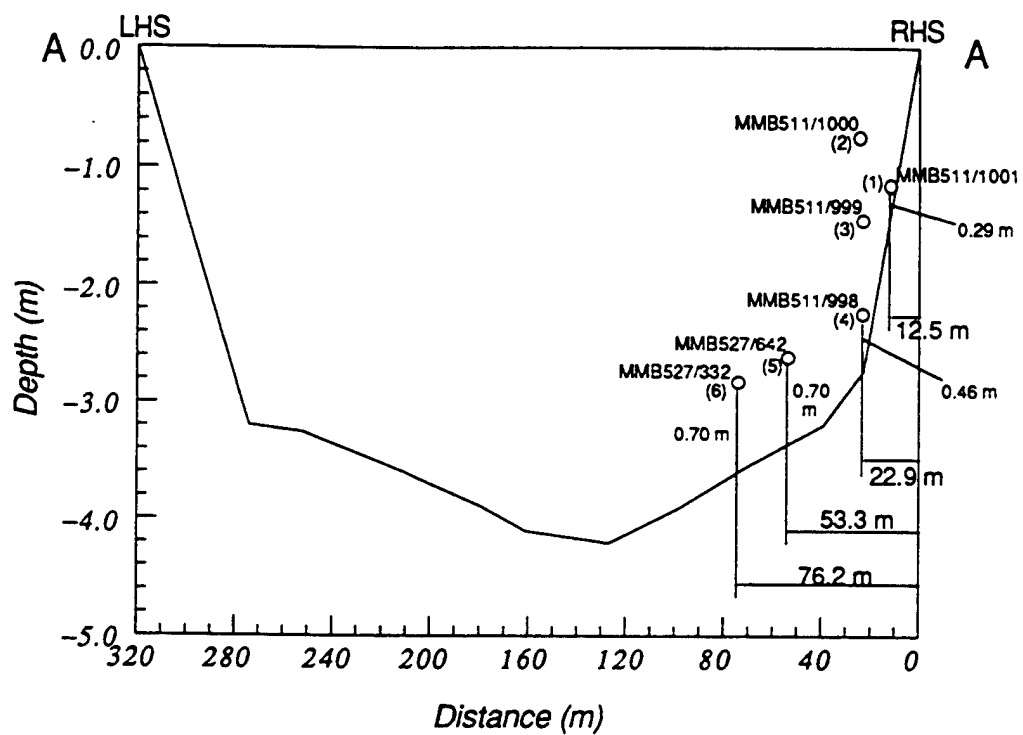


II-8. Location of suspended sediment sampling stations on the Illinois River near the Kampsville site during trip 1



- a1 - MMB511/1001, 0.29 m above river bed
- b1 - MMB511/998, 0.46 m above river bed
- b2 - MMB511/999, 1.31 m above river bed
- b3 - MMB511/1000, 2.13 m above river bed
- c1 - MMB527/642, 0.70 m above river bed
- d1 - MMB527/332, 0.70 m above river bed

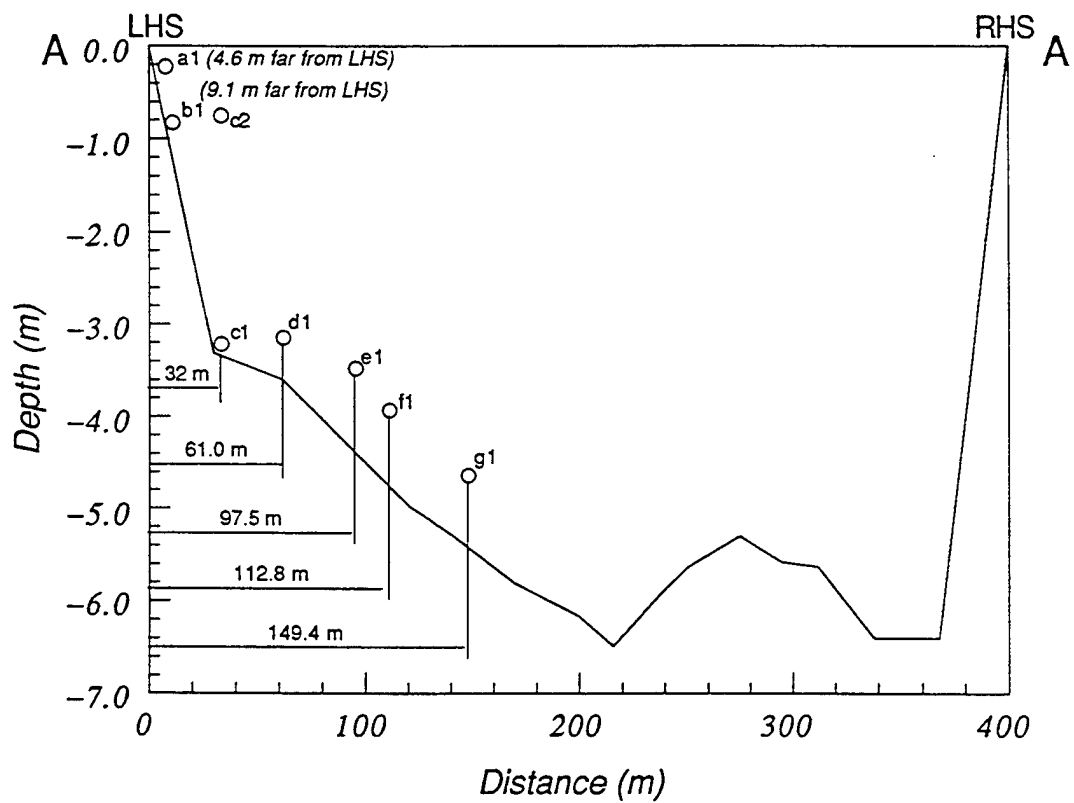
II-9. Plan view of Kampsville site for trip 2
and locations of current meters



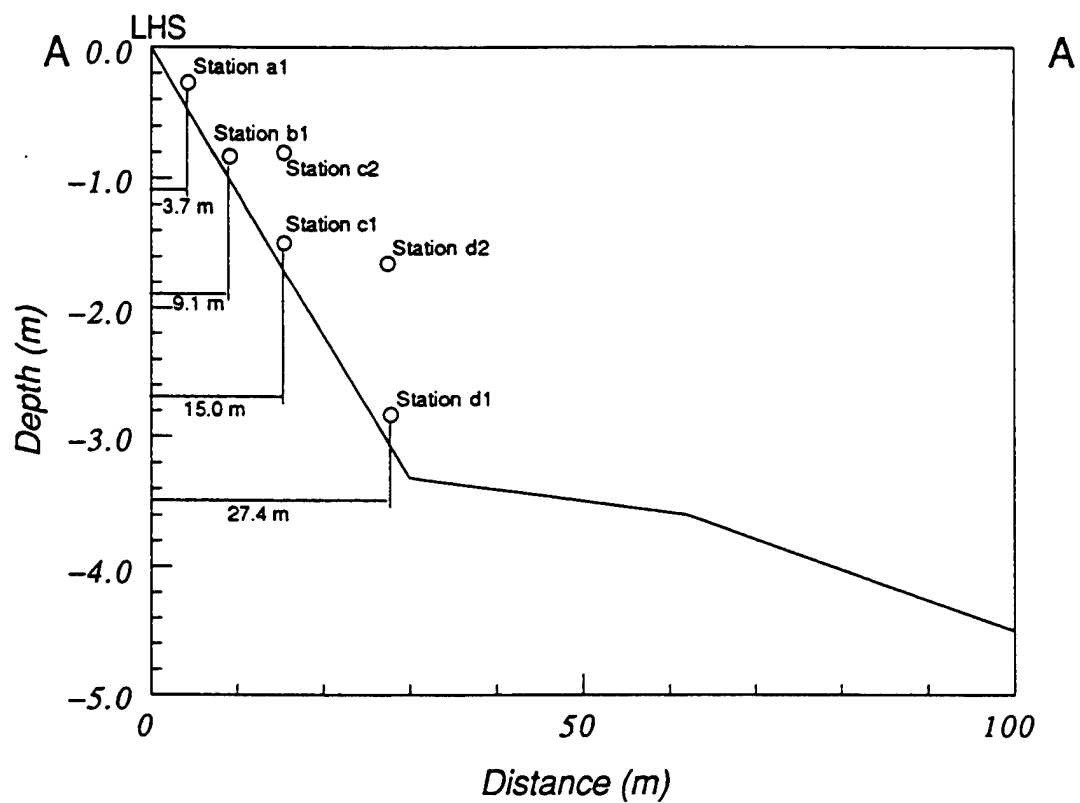
II-10. Cross section of the Illinois River at the Kampsville site for trip 2



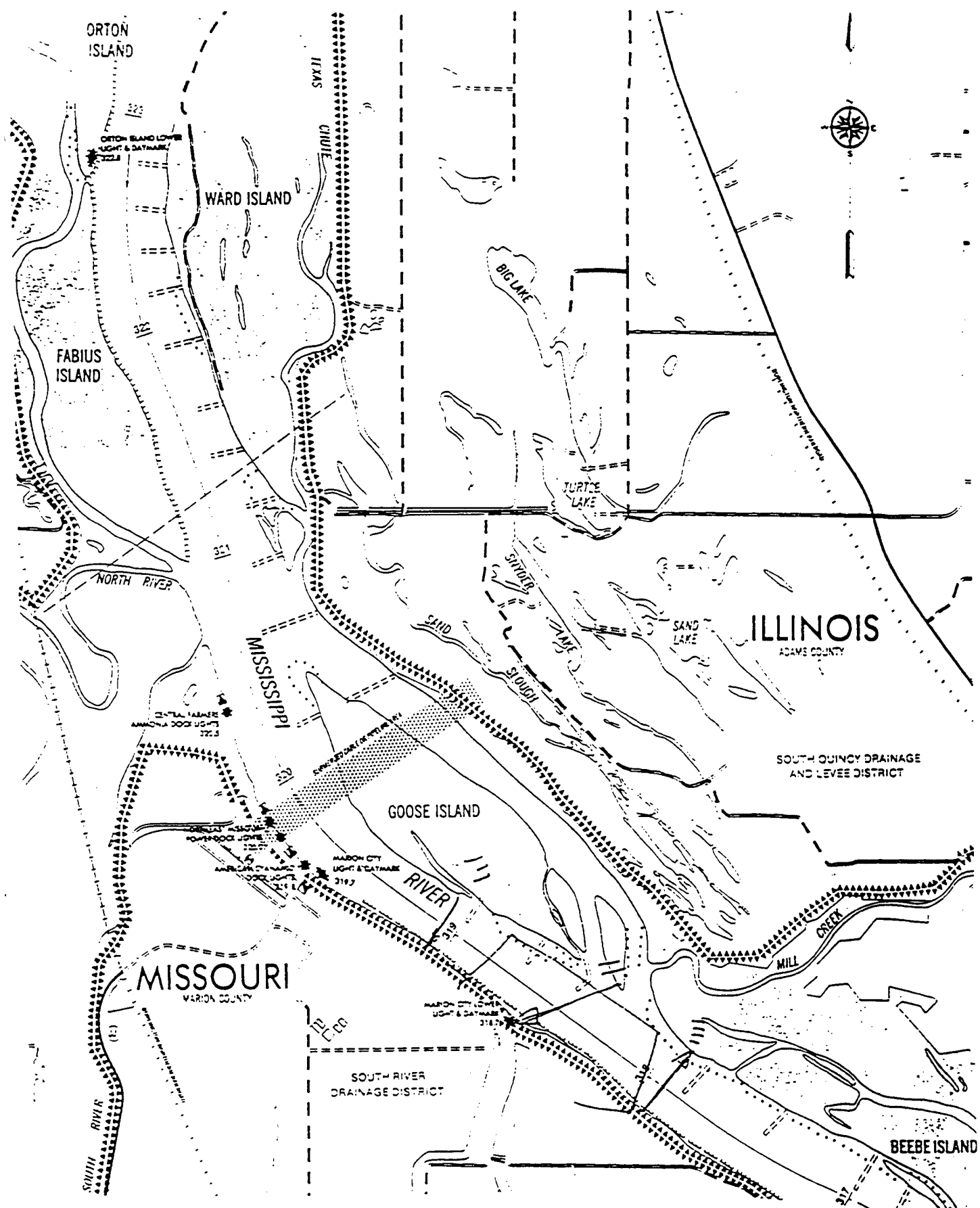
II-11. Apple River Island site on the Mississippi River



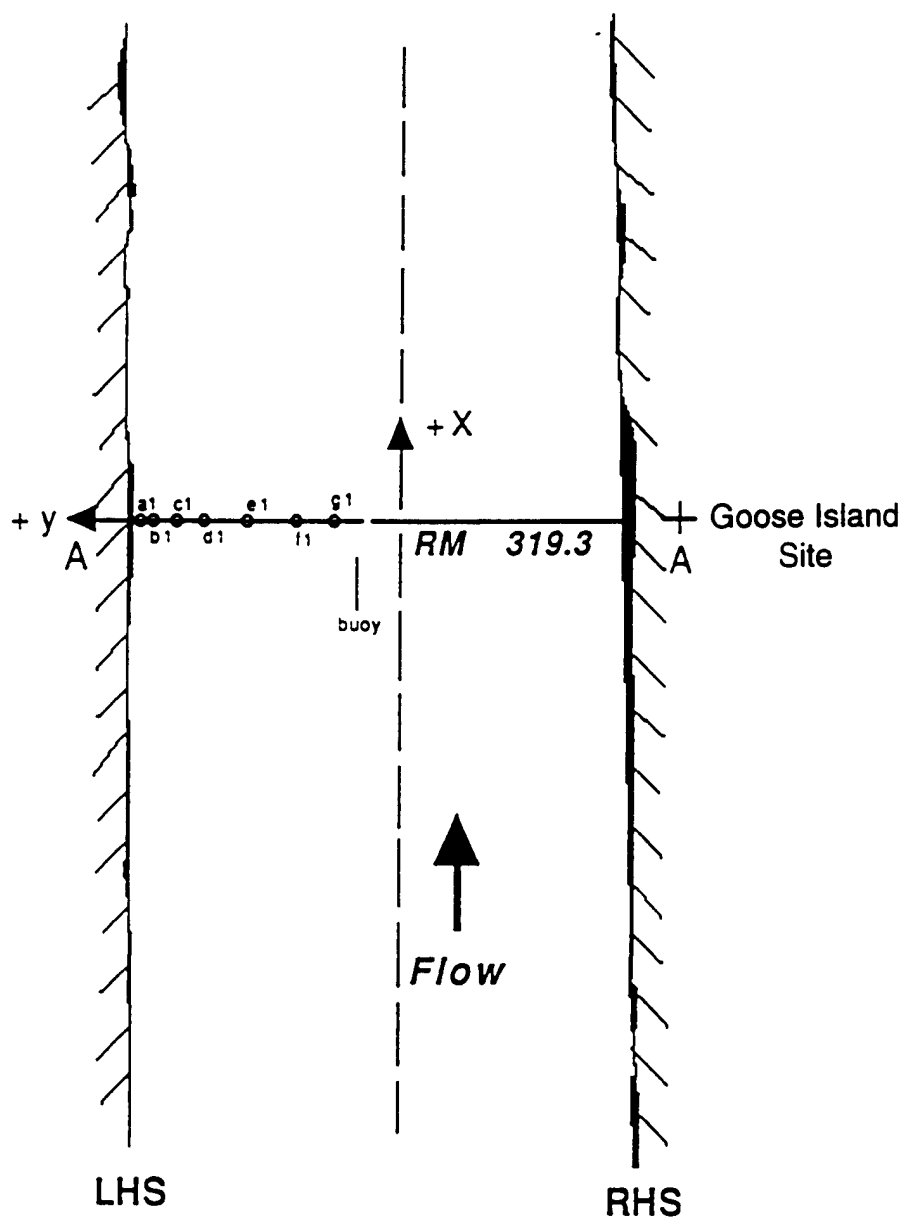
II-13. Cross section of the Mississippi River at the Apple River Island site



II-14. Location of suspended sediment sampling stations on the Mississippi River near the Apple River Island site

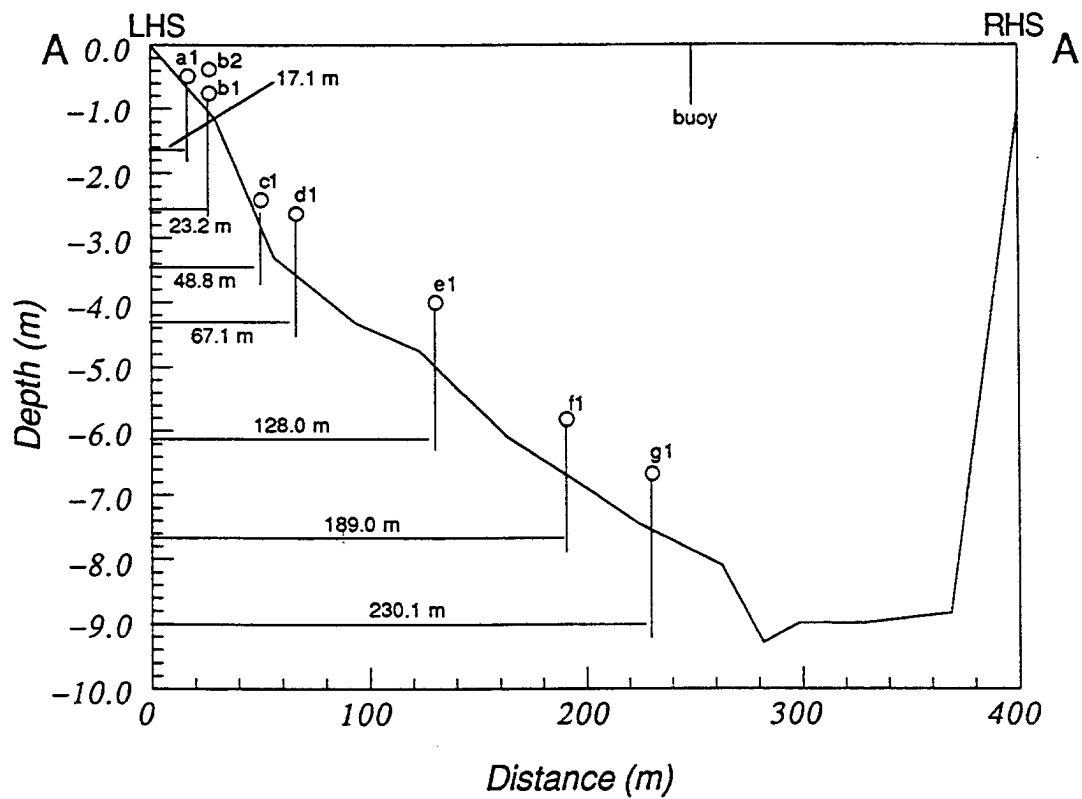


II-15. Goose Island site on the Mississippi River

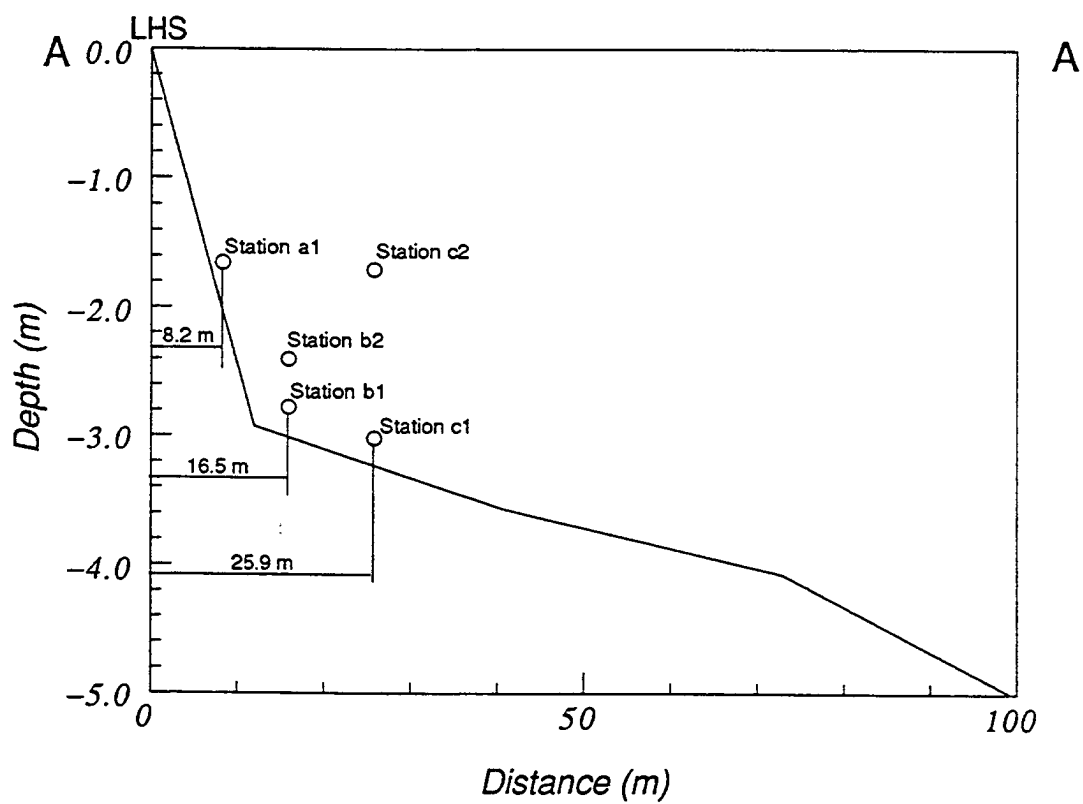


- a1 - MMB511/1000, 0.18 m above river bed
- b1 - MMB511/998, 0.25 m above river bed
- b2 - MMB511/999, 0.61 m above river bed
- c1 - MMB511/1001, 0.25 m above river bed
- d1 - MMB527/642, 0.91 m above river bed
- e1 - MMB527/332, 0.91 m above river bed
- f1 - S4/040, 0.91 m above river bed
- g1 - S4/071, 0.91 m above river bed

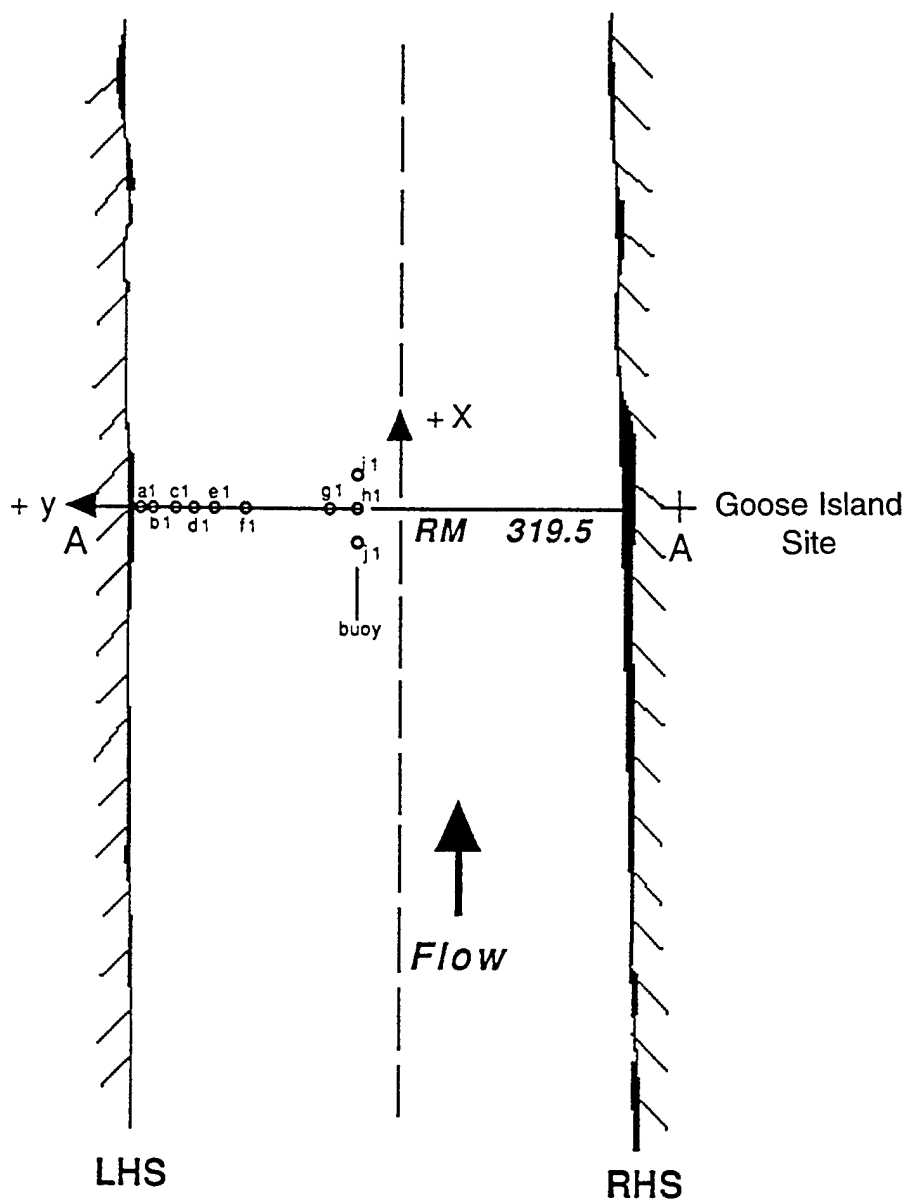
II-16. Plan view of the Goose Island site and locations of current meters for trip 1



II-17. Cross section of the Mississippi River
at the Goose Island site during trip 1

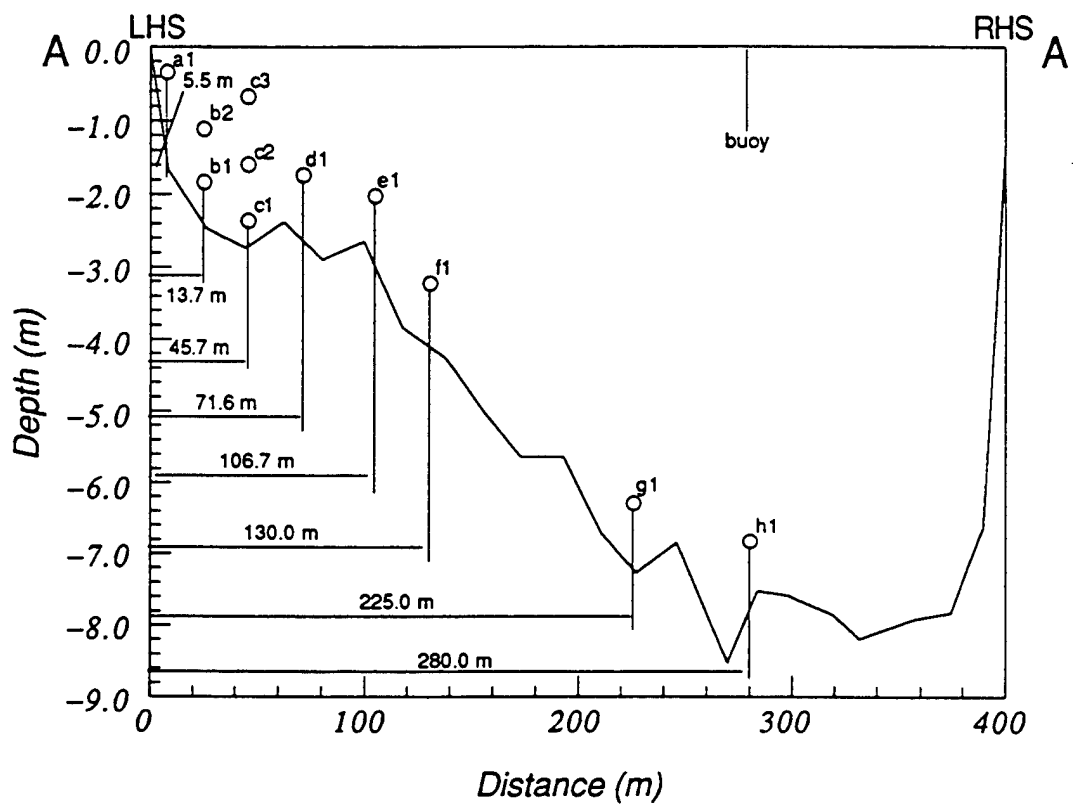


II-18. Location of suspended sediment sampling stations on the Mississippi River near the Goose Island site during trip 1

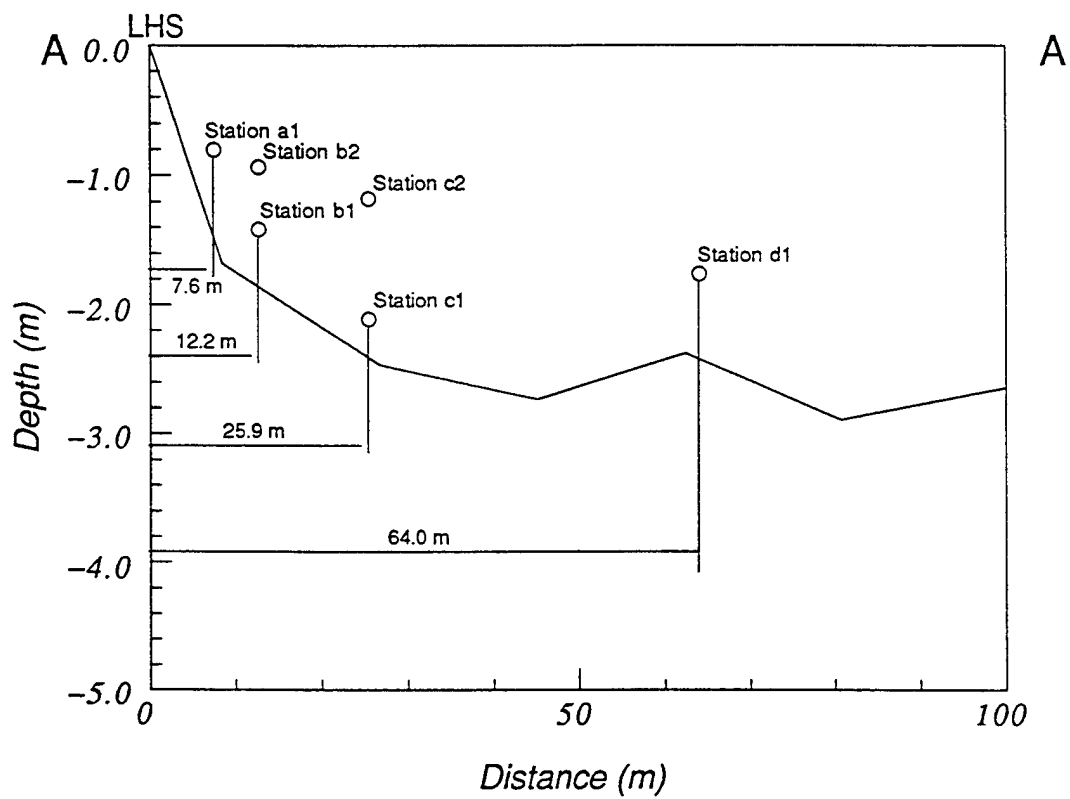


- a1 - MMB511/998, 0.69 m above river bed
- b1 - MMB511/1000, 0.61 m above river bed
- b2 - MMB511/999, 1.34 m above river bed
- c1 - MMB511/1130, 0.46 m above river bed
- c2 - MMB511/1131, 1.28 m above river bed
- c3 - MMB511/1001, 2.13 m above river bed
- d1 - MMB527/642, 0.91 m above river bed
- e1 - MMB527/332, 0.91 m above river bed
- f1 - S4/071, 0.91 m above river bed
- g1 - S4/834, 0.91 m above river bed
- h1 - S4/040, 0.91 m above river bed
- i1 - S4/832, 0.91 m above river bed
- j1 - S4/151, 0.91 m above river bed

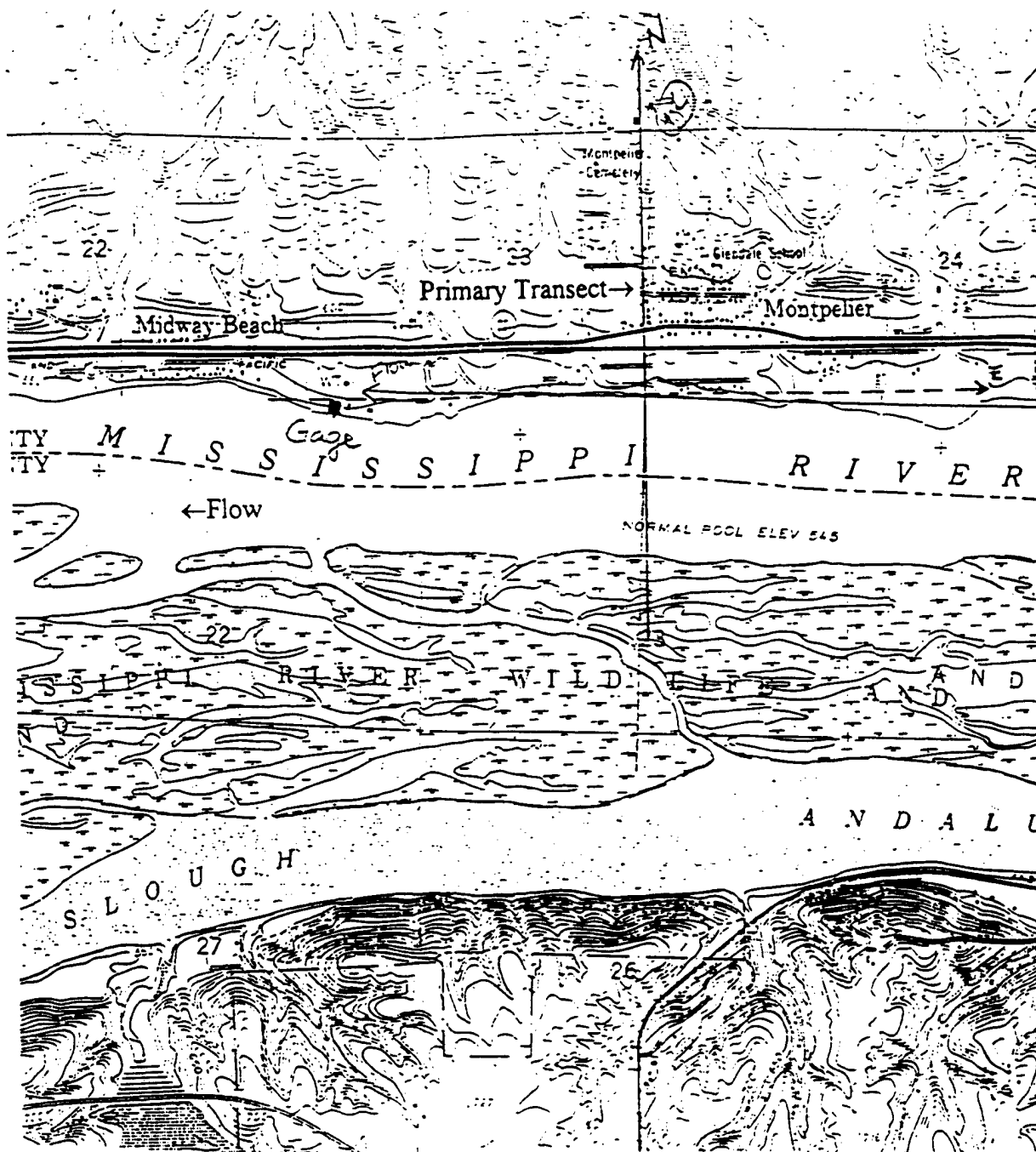
II-19. Plan view of the Goose Island site
and locations of current meters for trip 2



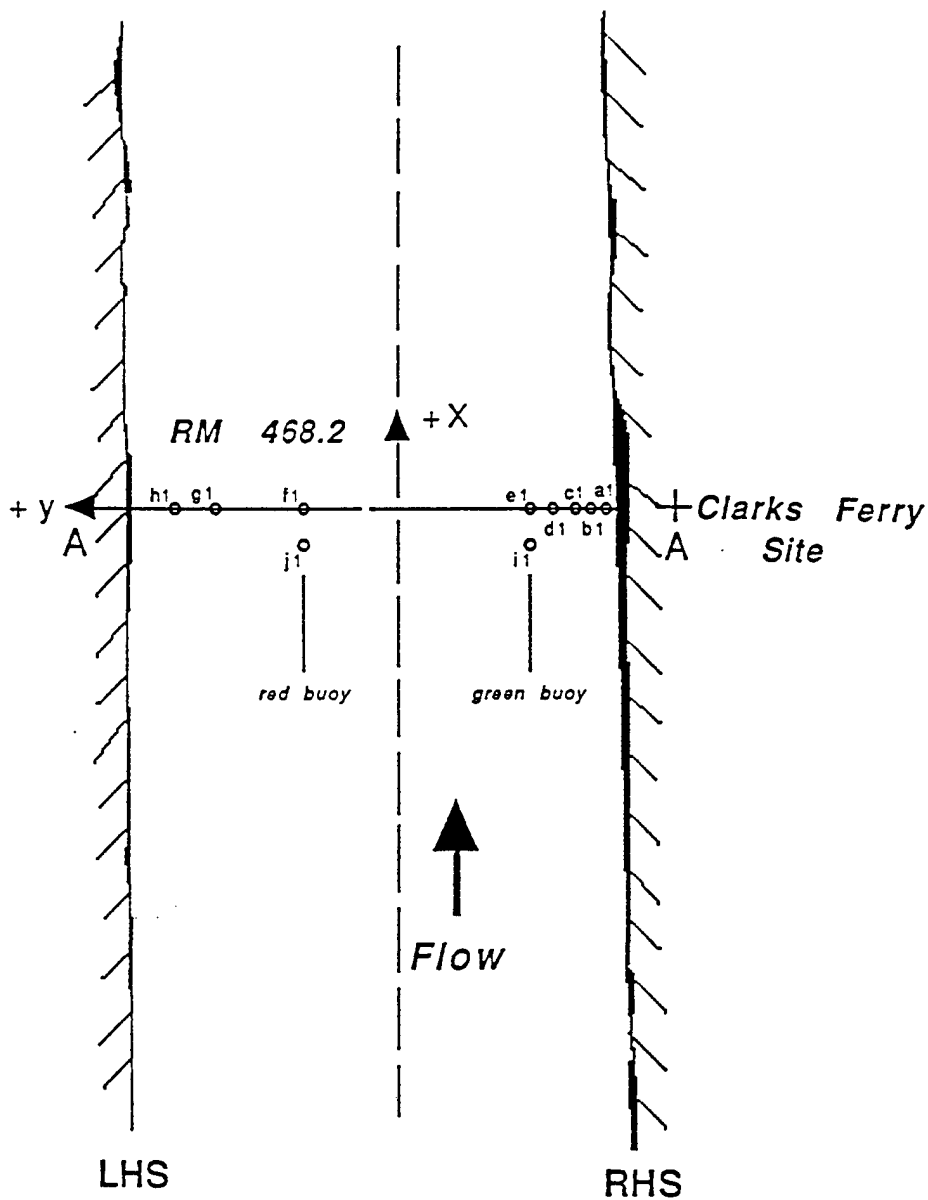
II-20. Cross section of the Mississippi River
at the Goose Island site during trip 2



II-21. Location of suspended sampling stations
on the Mississippi River near the Goose Island site during trip 2

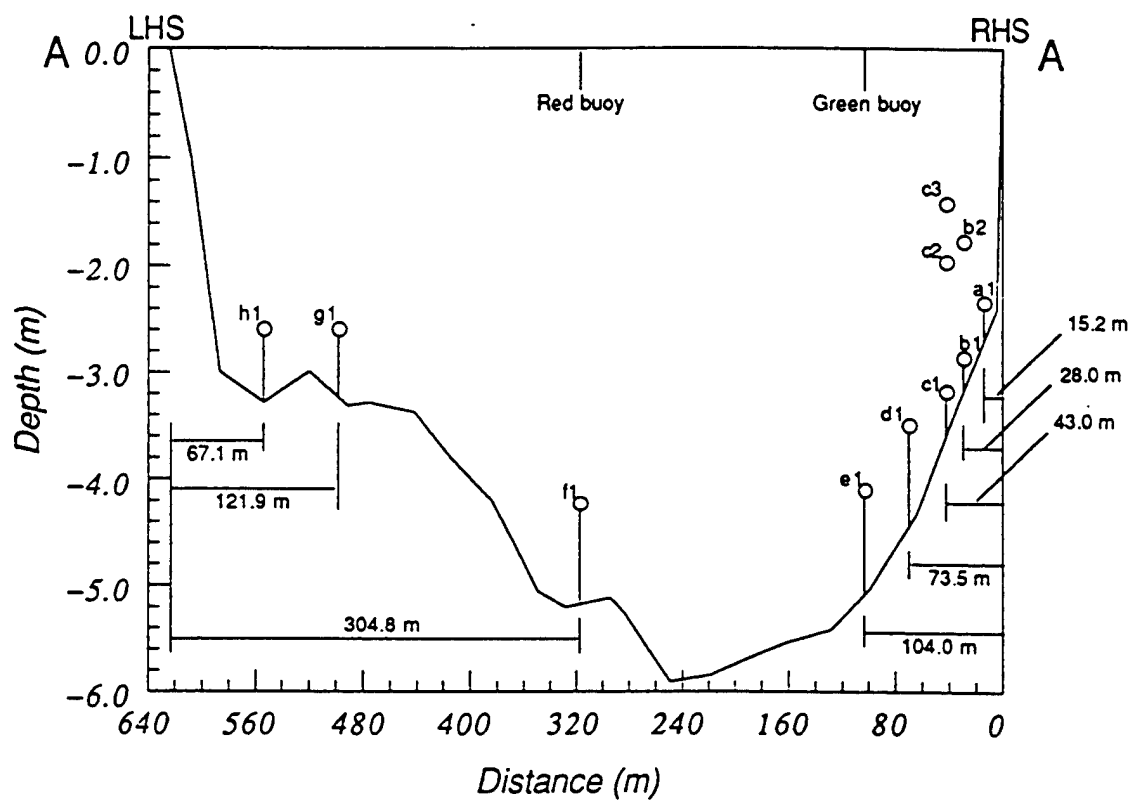


II-22. Clarks Ferry site on the Mississippi River

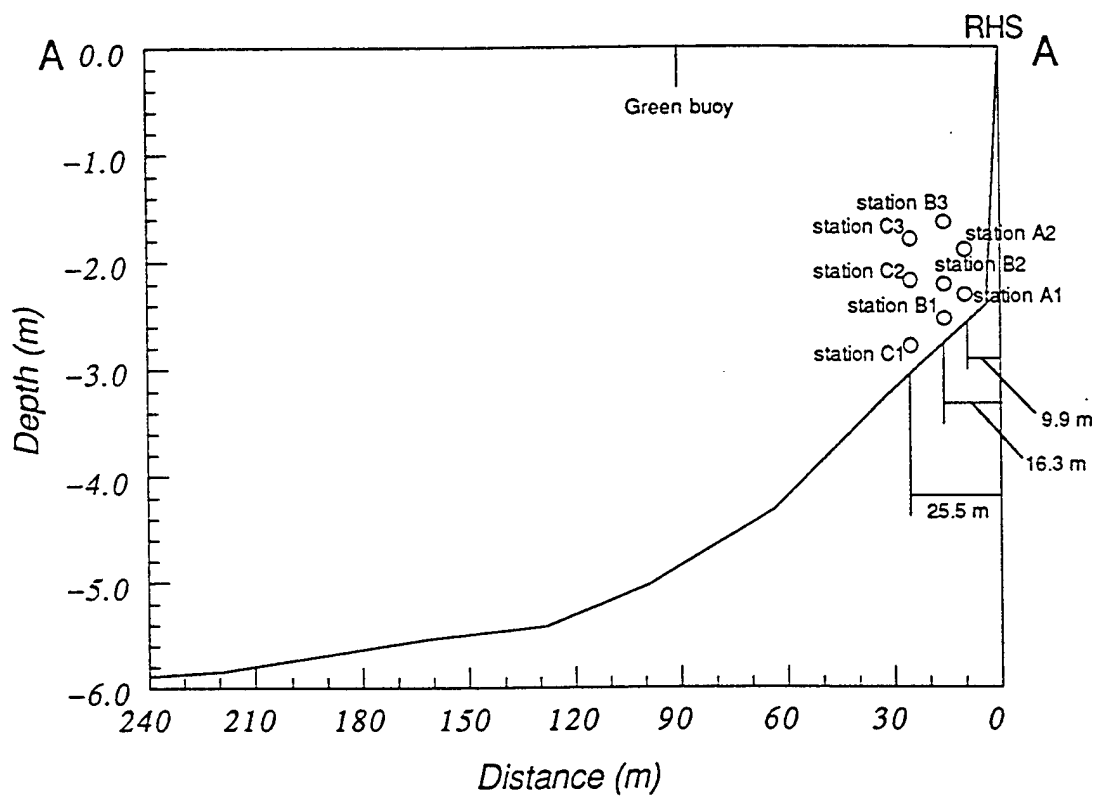


- a1 - MMB511/1001, 0.35 m above river bed
- b1 - MMB511/1330, 0.33 m above river bed
- b2 - MMB511/1331, 1.52 m above river bed
- c1 - MMB511/998, 0.36 m above river bed
- c2 - MMB511/999, 1.62 m above river bed
- c3 - MMB511/1000, 2.53 m above river bed
- d1 - S4/151, 1.0 m above river bed
- e1 - S4/834, 1.0 m above river bed
- f1 - S4/040, 1.0 m above river bed
- g1 - MMB527/332, 0.70 m above river bed
- h1 - MMB527/642, 0.70 m above river bed
- i1 - S4/832, 1.0 m above river bed
- j1 - S4/071, 1.0 m above river bed

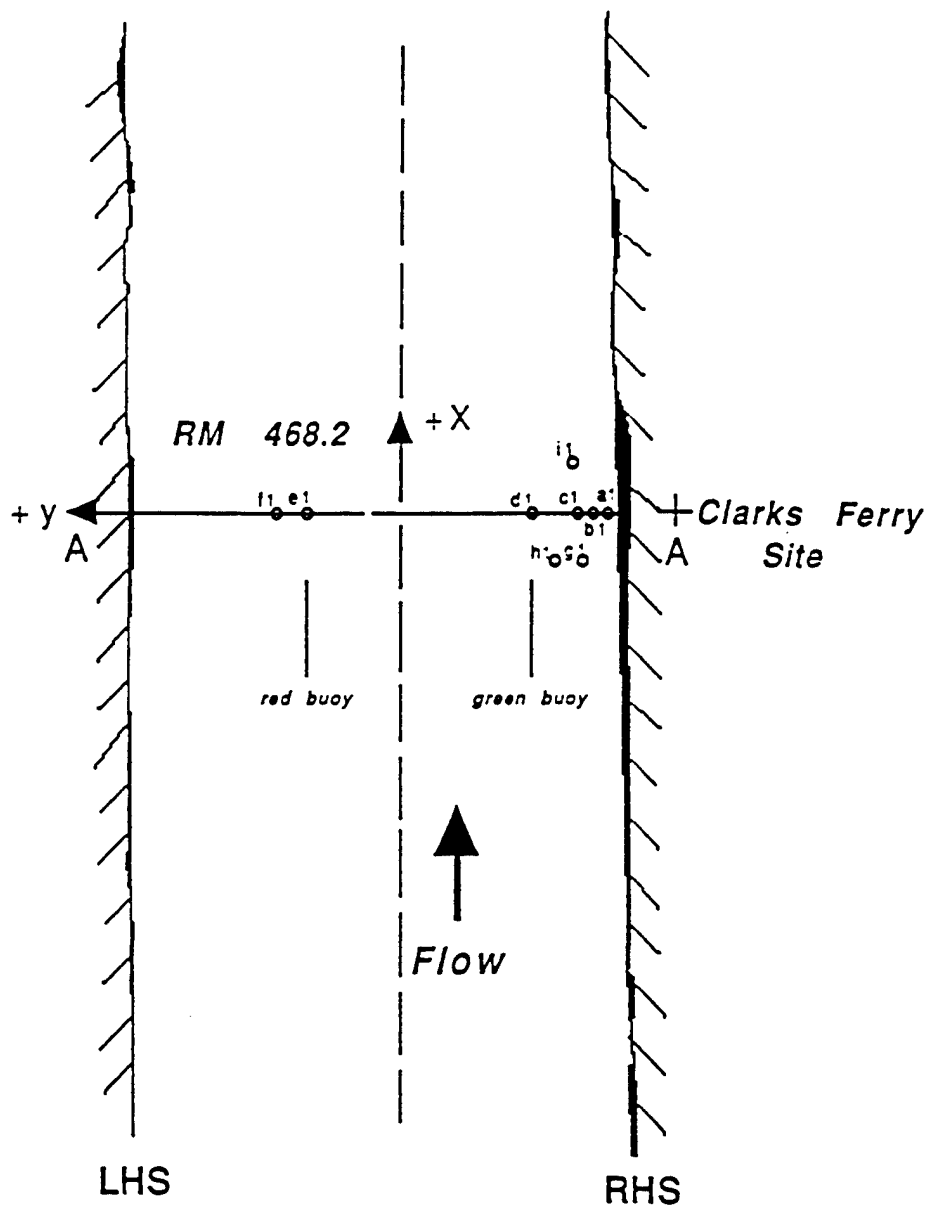
II-23. Plan view of the Clarks Ferry site for trip 1
and locations of current meters



II-24. Cross section of the Mississippi River at the Clarks Ferry site for trip 1

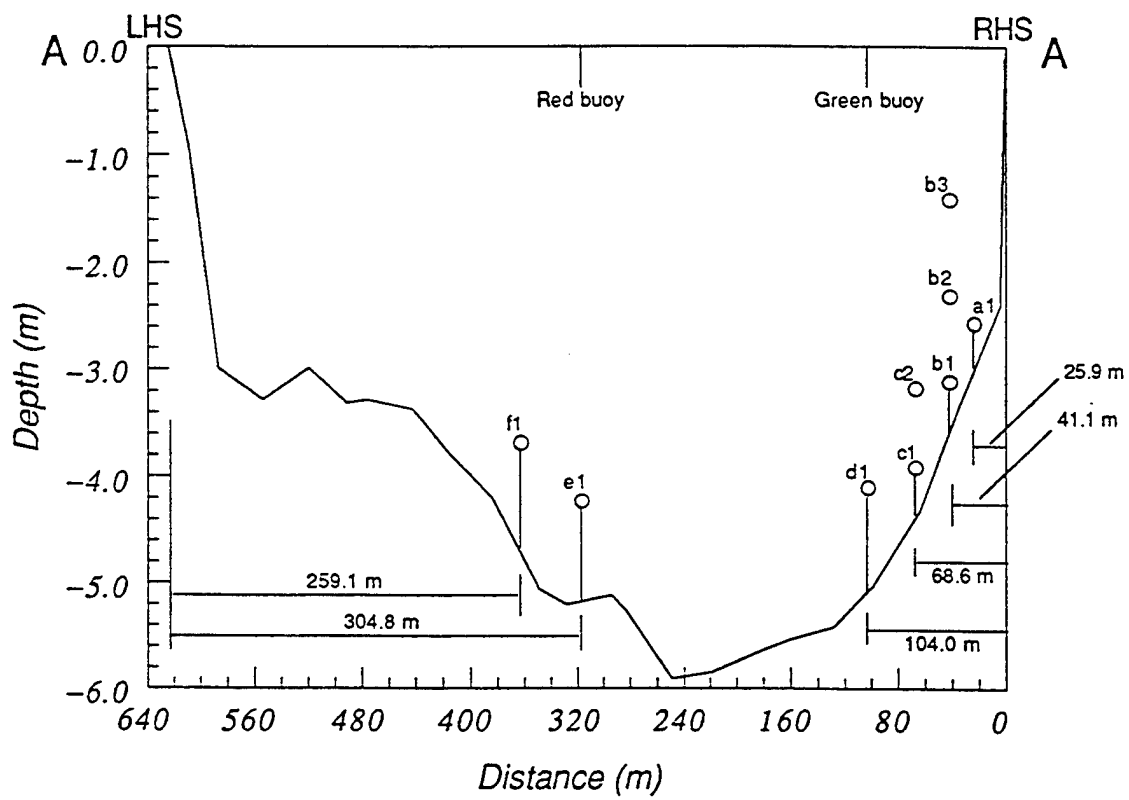


II-25. Location of suspended sediment sampling stations on the Mississippi River near the Clarks Ferry site during trip 1



- a1 - MMB511/1001, 0.45 m above river bed
- b1 - MMB511/998, 0.51 m above river bed
- b2 - MMB511/999, 1.24 m above river bed
- b3 - MMB511/1000, 2.16 m above river bed
- c1 - MMB511/1130, 0.50 m above river bed
- c2 - MMB511/1131, 1.21 m above river bed
- d1 - S4/834, 1.0 m above river bed
- e1 - S4/151, 1.0 m above river bed
- f1 - S4/832, 1.0 m above river bed
- g1 - MMB527/642, 0.94 m above river bed
- h1 - S4/040, 1.0 m above river bed
- i1 - MMB527/332, 0.94 m above river bed

II-26. Plan view of the Clarks Ferry site on the Mississippi River for trip 2



II-27. Cross section of the Mississippi River at the Clarks Ferry site for trip 2

APPENDIX III.

**BED MATERIAL CHARACTERISTICS AND LOCATION
OF BED MATERIAL SAMPLING AT ALL STUDY SITES**

McEver's Island Site

Location		Dist. (ft)	Characteristics of Bed Material Particle Size (mm)							
			d_{10}	d_{16}	d_{50}	d_{60}	d_{85}	d_{95}	σ	U
6/15/89										
RM49.5	B3*	165	0.19	0.23	0.31	0.34	0.45	0.60	1.40	1.79
REW-LEW	C3	155	0.22	0.24	0.32	0.35	0.42	0.52	1.32	1.59
	D3	135	0.25	0.27	0.36	0.4	0.51	0.75	1.38	1.60
	E3	120	0.19	0.20	0.30	0.34	0.55	2.0	1.67	1.79
	F3	105	0.21	0.23	0.27	0.3	0.4	0.50	1.33	1.43
	J3	35	-	-	0.02	0.028	-	-	-	-
	K3	20	-	-	0.014	0.02	-	-	-	-
6/15/89	A4	40	-	-	0.021	0.03	-	-	-	-
RM50.1	B4	55	-	-	0.19	0.28	0.45	0.6	-	-
LEW-REW	C4	70	0.013	0.026	0.23	0.26	0.35	0.5	5.18	20
	D4	105	0.28	0.31	0.472	0.46	0.58	0.75	1.37	1.64
	E4	125	0.27	0.3	0.4	0.44	0.57	0.75	1.38	1.63
	F4	140	0.3	0.34	0.5	0.56	1.1	3	1.84	1.87
	G4*	155	0.25	0.27	0.49	0.59	1.5	3	2.44	2.36
	I4	185	0.21	0.22	0.28	0.31	0.41	0.5	1.37	1.48
	K4	215	-	0.007	0.15	0.2	0.29	0.35	11.68	-
	L4	240	-	-	0.03	-	-	-	-	-
	M4	260	-	0.008	0.06	0.1	0.2	0.25	5.42	-
	N4	280	-	0.004	0.049	0.075	0.17	0.25	7.86	-
6/15/89	A5	230	-	0.002	-	-	-	-	-	-
RM50.5	B5	215	-	0.006	0.2	0.26	0.39	0.5	17.64	-
REW-LEW	C5	200	0.25	0.25	0.36	0.4	0.59	0.8	1.54	1.6
	D5*	185	0.20	0.26	0.40	0.45	0.65	1.0	1.7	2.25
	E5	170	0.24	0.26	0.35	0.37	0.49	0.65	1.37	1.54
	F5	165	-	-	0.08	0.17	0.28	0.35	-	-
	G5	140	0.002	0.01	0.11	0.13	0.18	0.25	6.32	65

Note: * contained shells that cannot be separated

REW: Right edge of water

LEW: Left edge of water

Both REW and LEW are defined as we look downstream the river.

$$\sigma = \frac{1}{2} \left[\frac{d_{85}}{d_{50}} + \frac{d_{50}}{d_{16}} \right]$$

$$U = \frac{d_{60}}{d_{10}}$$

Kampsville Site, Trip 1

			<i>Characteristics of Bed Material Particle Size (mm)</i>							
<i>Location</i>		<i>Dist. (ft)</i>	<i>d₁₀</i>	<i>d₁₆</i>	<i>d₅₀</i>	<i>d₆₀</i>	<i>d₈₅</i>	<i>d₉₅</i>	<i>σ</i>	<i>U</i>
10/15/90	A1	349	-	-	0.024	0.031	-	-	-	-
RM 35.2	A3	310		0.0023	-	-	-	-	-	-
K13	A4	290	-	-	0.014	0.018	0.032	-	-	-
LEW-REW	A5	271	-	-	0.08	0.013	0.029	-	-	
	A6	254	-	-	0.012	0.019	-	-		
	A7*	233	0.19	0.20	0.30	0.34	0.45	0.60	1.50	1.79
	A8*	213	0.20	0.23	0.34	0.37	0.49	0.65	1.46	1.85
	A9*	193	0.20	0.24	0.35	0.39	0.59	2	1.57	1.95
	A11	148	-	-	0.24	0.27	0.42	0.60	-	-
10/15/90	A12	133	-	0.006	0.18	0.22	0.35	0.6	2.77	-
RM 35.1	A13	112	-	0.052	0.17	0.22	0.45	1	2.96	-
LEW-REW	A14	93	0.006	0.018	0.23	0.28	0.55	2	7.58	46.67
	A15	70	-	-	0.032	0.095	0.35	0.6	-	-
	A16	50	-	0.0042	0.07	0.18	0.34	0.5	10.76	-
	A17	30	-	0.004	0.15	0.2	0.35	0.45	19.92	-
10/10/90	B1	374.5	-	-	0.017	0.022	-	-	-	-
RM 35.2	B2	354.3	-	-	0.014	0.023	-	-	-	-
LEW-REW	B3	330.0	-	-	0.018	0.024	-	-	-	-
	B4	311.0	-	-	0.011	0.017	-	-	-	-
	B5	293.0	0.0022	0.012	0.2	0.24	0.35	0.45		109.09
	B6*	274.0	0.19	0.22	0.29	0.32	0.41	0.48	1.37	1.68
	B7*	255.0	0.19	0.22	0.32	0.35	0.46	0.65	1.45	1.84
	B8*	232.0	0.19	0.22	0.32	0.35	0.48	0.70	1.48	1.84
	B9*	212.0	0.18	0.19	0.27	0.30	0.4	0.5	1.45	1.67
	B10*	191.0	0.13	0.19	0.35	0.45	10.4	-	15.78	3.46
	B11	171.0	-	0.006	0.19	0.21	0.35	0.55	16.75	-
	B12	152.0	-	0.024	-	-	-	-		-
	B14	112.0	-	-	0.019	0.026	-	-		-
	B15	91	-	-	0.013	0.018	-	-		-
10/18/90	C2	300	-	-	-	-	-	-		-
RM 35.2	C4	259	-	-	0.016	0.019	-	-		-
LEW-REW	C6	217	0.002	0.013	0.22	0.25	0.35	0.45		-
	C8*	178	0.20	0.23	0.33	0.36	0.49	0.7	1.46	1.80
	C12	99	-	-	0.018	0.029	-	-		
	C14	57	-	-	0.0055	0.01	-	-		

Note: * contained shells that cannot be separated

Kampsville Site, Trip 2

Characteristics of Bed Material Particle Size (mm)

Location	Dist. (ft)	d_{10}	d_{16}	d_{50}	d_{60}	d_{85}	d_{95}	σ	U
8/8/91 A	50	-	-	0.032	-	-	-	-	-
RM 35.4 B	100	-	-	0.018	0.027	-	-	-	-
REW-LEW C	260	-	0.005	0.18	0.24	0.35	0.7	18.97	-
D	355	-	-	0.025	-	-	-	-	-
E	460	-	-	0.115	0.19	0.29	0.45	-	-
F	540	0.21	0.23	0.35	0.39	0.5	0.65	1.475	-
G	652	0.2	0.22	0.3	0.34	0.45	0.5	1.432	-
H	752	-	-	0.01	0.017	0.026	-	-	-
I	847	-	-	0.0023	0.0046	0.015	0.025	-	-
J	952	-	-	0.011	0.018	-	-	-	-

Apple River Island Site

Characteristics of Bed Material Particle Size (mm)

Location	Dist. (ft)	d_{10}	d_{16}	d_{50}	d_{60}	d_{85}	d_{95}	σ	U
5/22/90 A	338	0.28	0.31	0.37	0.39	0.54	0.7	1.33	1.39
RM 546.3 B	312	0.35	0.36	0.58	0.69	1.5	2.5	2.10	1.97
REW-LEW C	295	0.38	0.41	0.55	0.62	1.16	2.5	1.73	1.63
D	275	0.35	0.39	0.51	0.55	0.85	1.4	1.49	1.57
E	251	0.35	0.39	0.51	0.55	0.85	1.4	1.49	1.57
F	240	0.29	0.33	0.41	0.45	0.54	0.8	1.28	1.55
G	216	0.3	0.35	0.48	0.5	0.65	1	1.36	1.67
H	200	0.34	0.37	0.49	0.5	0.62	0.9	1.29	1.47
I	170	0.28	0.34	0.5	0.58	0.97	1.7	1.71	2.07
J	141	0.29	0.35	0.52	0.61	0.99	1.9	1.63	2.10
K	120	0.29	0.34	0.44	0.5	0.85	3	1.61	1.72
L	62	0.26	0.29	0.39	0.4	0.54	0.65	1.36	1.54
M	30	0.25	0.27	0.37	0.39	0.49	.6	1.35	1.56
5/23/96 A	338	0.46	0.52	0.74	0.85	1.60	3.00	1.79	1.85
RM 546.4 B	312	0.40	0.44	0.50	0.53	0.71	0.95	1.28	1.33
REW-LEW C	295	**small sample - just 25 grams total dry weight**							
D	275	0.30	0.34	0.49	0.55	0.76	1.40	1.50	1.83
E	251	0.38	0.42	0.56	0.62	0.95	1.70	1.51	1.63
F	240	0.28	0.30	0.42	0.45	0.60	0.90	1.41	1.61
G	216	0.28	0.30	0.39	0.42	0.51	0.63	1.30	1.50
H	200	0.27	0.29	0.41	0.46	0.80	1.90	1.68	1.70
I	170	0.28	0.32	0.48	0.51	0.83	1.50	1.61	1.82
J	141	0.28	0.31	0.48	0.54	0.90	1.80	1.71	1.93
K*	120	0.27	0.30	0.55	0.69	3.00	6.50	3.64	2.56
L*	62	0.23	0.26	0.38	0.41	0.58	0.90	1.49	1.78
M*	30	0.19	0.22	0.28	0.30	0.35	0.40	1.26	1.58
N*	0	0.19	0.22	0.35	0.40	0.65	8.00	1.72	2.11

Note: * contained shells that cannot be separated

Apple River Island Site (Concluded)

Location		Dist. (ft)	Characteristics of Bed Material Particle Size (mm)							
			d_{10}	d_{16}	d_{50}	d_{60}	d_{85}	d_{95}	σ	U
5/23/90	A	304	0.39	0.4	0.55	0.6	1.14	1	1.32	1.54
RM 546.7	C	255	0.28	0.33	0.5	0.59	1.47	2.3	1.86	2.11
REW-LEW	D	242	0.32	0.39	0.64	0.72	0.78	2.5	1.97	2.25
	E	197	0.24	0.28	0.48	0.52	0.65	1.6	1.67	2.17
	F	150	0.29	0.28	0.45	0.49	1.3	0.9	1.53	1.88
	G	120	0.28	0.33	0.55	0.65	0.9	2	2.02	2.32
	H	90	0.29	0.34	0.54	0.55	0.6	1.5	1.63	1.90
	I	60	0.24	0.27	0.37	0.41	5	09	1.50	1.71
	J*	129	0.15	0.17	0.34	0.41		8	8.35	2.73

Note: *contained shells that cannot be separated.

Goose Island Site, Trip 1

			Characteristics of Bed Material Particle Size (mm)							
Location		Dist. (m)	d_{10}	d_{16}	d_{50}	d_{60}	d_{85}	d_{95}	σ	U
8/29/90	A5		0.41	0.45	0.65	0.7	0.95	1.4	1.45	1.71
RM 319.3	A6		0.32	0.35	0.49	0.5	0.75	1.4	1.47	1.56
GI12	A7		0.3	0.35	0.5	0.54	0.78	1.2	1.49	1.80
	A8		0.28	0.3	0.38	0.4	0.54	0.7	1.34	1.43
	A9		0.27	0.31	0.41	0.46	0.72	1.7	1.54	1.70
	A10		0.29	0.34	0.51	0.6	1.1	2	1.83	2.07
	A11		0.2	0.22	0.29	0.34	0.54	0.8	1.59	1.70
	A12		0.29	0.39	0.69	0.72	0.99	1.5	1.60	2.48
8/29/90	B5	282	0.24	0.27	0.4	0.44	0.6	0.8	1.49	1.83
RM 319.3	B6	263	0.35	0.39	0.59	0.65	0.93	1.5	1.54	1.86
LEW-REW	B7	224	0.28	0.3	0.45	0.5	0.7	1	1.53	1.79
	B8	200	0.26	0.28	0.4	0.44	0.6	0.7	1.46	1.69
	B9	164	0.23	0.26	0.42	0.48	0.7	1.4	1.64	2.09
	B10	123	0.26	0.28	0.43	0.48	0.67	0.9	1.55	1.85
	B11	94	0.19	0.22	0.28	0.3	0.37	0.5	1.30	1.58
	B12	57	0.3	0.36	0.54	0.59	0.74	0.91	1.44	1.97
	B13	30	0.39	0.45	0.65	0.7	0.95	1.5	1.45	1.79
8/29/90	04	359	0.55	0.66	1.24	1.47	2.3	3.5	1.87	2.67
GI12-TRC	05	335	0.46	0.54	0.88	1	1.7	2.2	1.78	2.17
LEW-REW	06	297	0.39	0.44	0.63	0.69	0.95	1.6	1.47	1.77
	07	271	0.35	0.4	0.5	0.51	0.64	0.79	1.27	1.46
	08	232	0.29	0.34	0.48	0.49	0.6	0.82	1.33	1.69
	09	200	0.27	0.32	0.47	0.5	0.7	1.1	1.48	1.85

Goose Island Site, Trip 1 (Concluded)

Location		Dist. (m)	Characteristics of Bed Material Particle Size (mm)							
			d_{10}	d_{16}	d_{50}	d_{60}	d_{85}	d_{95}	σ	U
G12-TRC	10	164	0.31	0.35	0.5	0.55	0.85	1.3	1.56	1.77
REW-LEW	11	140	0.3	0.34	0.48	0.5	0.65	0.85	1.38	1.67
	12	105	0.29	0.32	0.48	0.52	0.72	1	1.50	1.79
	13	78	0.27	0.31	0.48	0.51	0.75	1.1	1.56	1.89
	14	46	0.24	0.27	0.38	0.41	0.59	0.8	1.48	1.71
	15	17	0.16	0.17	0.19	0.21	0.29	0.37	1.32	1.31

Goose Island Site, Trip 2

			Characteristics of Bed Material Particle Size (mm)							
Location		Dist. (ft)	d_{10}	d_{16}	d_{50}	d_{60}	d_{85}	d_{95}	σ	U
7/20/91	820	820	0.27	0.31	0.45	0.48	0.62	0.94	1.42	1.78
RM 319.5	702	702	0.34	0.41	0.66	0.75	1.2	1.82	1.71	2.21
TR2	645	645	0.28	0.31	0.44	0.48	0.65	0.95	1.45	1.71
REW-LEW	580	580	0.28	0.31	0.4	0.45	0.65	0.9	1.46	1.61
	520	520	0.3	0.35	0.49	0.54	0.8	1.2	1.52	1.8
	464	464	0.27	0.31	0.54	0.63	1.00	1.70	1.8	2.33
	398	398	0.26	0.28	0.42	0.49	0.90	2.40	1.82	1.88
	340	340	0.28	0.30	0.36	0.39	0.55	0.81	1.36	1.39
	277	277	0.24	0.26	0.37	0.39	0.59	1	1.51	1.63
	217	217	0.22	0.25	0.36	0.39	0.55	0.7	1.48	1.77
	160	160	0.21	0.23	0.35	0.37	0.46	0.59	1.42	1.76
	100	100	0.19	0.21	0.25	0.26	0.34	0.4	1.28	1.37
	7/21/91	887	904	0.24	0.26	0.38	0.41	0.59	0.8	1.51
RM 319.8	830	847	0.24	0.26	0.44	0.49	0.7	0.95	1.64	2.04
GISC	768	785	0.26	0.31	0.70	0.83	1.5	2	2.2	3.19
REW-LEW	710	724	0.28	0.31	0.48	0.51	0.71	1	1.51	1.82
	651	668	0.28	0.34	0.5	0.54	0.74	1	1.48	1.93
	591	605	0.34	0.39	0.55	0.59	0.83	1.22	1.46	1.74
	529	546	0.27	0.31	0.46	0.49	0.6	0.75	1.39	1.82
	467	484	0.35	0.39	0.49	0.51	0.61	0.81	1.25	1.46
	407	424	0.326	0.36	0.49	0.5	0.65	0.87	1.37	1.53
	349	366	0.31	0.36	0.49	0.51	0.66	0.9	1.35	1.65
	290	307	0.29	0.34	0.46	0.49	0.61	0.9	1.34	1.69
	231	248	0.27	0.31	0.41	0.45	0.7	2	1.52	1.67
	165	182	0.29	0.33	0.48	0.51	0.7	1	1.46	1.76
	110	129	0.29	0.31	0.45	0.49	0.58	0.8	1.37	1.69
	50	69	0.21	0.24	0.35	0.38	0.5	0.65	1.44	1.81
	20	34	0.15	0.18	0.26	0.32	0.50	0.68	1.68	2.13
	?		0.19	0.21	0.30	0.35	0.51	0.8	1.56	1.84

Clarks Ferry Site, Trip 1

			<i>Characteristics of Bed Material Particle Size (mm)</i>							
<i>Location</i>		<i>Dist. (m)</i>	<i>d₁₀</i>	<i>d₁₆</i>	<i>d₅₀</i>	<i>d₆₀</i>	<i>d₈₅</i>	<i>d₉₅</i>	<i>σ</i>	<i>U</i>
5/23/91	A	642	-	0.005	0.15	0.2	0.32	0.45	16.1	-
RM 468.3	B	604	0.28	0.35	0.52	0.57	0.75	0.95	1.46	2.04
XS3	C	554	0.22	0.24	0.35	0.38	0.55	0.8	1.51	1.73
LEW-REW	D	497	0.21	0.24	0.37	0.4	0.75	1.5	1.78	1.90
	E	444	0.22	0.24	0.32	0.36	0.51	0.8	1.46	1.64
	F	408	0.23	0.24	0.35	0.36	0.45	0.57	1.37	1.57
	G	343	0.28	0.31	0.41	0.47	0.65	0.81	1.45	1.68
	H	298	0.25	0.29	0.36	0.39	0.5	0.61	1.32	1.56
	I	248	0.28	0.31	0.47	0.5	0.75	1.2	1.56	1.79
	J	192	0.29	0.32	0.43	0.49	0.8	1.4	1.60	1.69
5/22/91	A	615	0.002	0.017	0.22	0.27	0.4	0.5	7.38	
RM 468.1	B	575	0.28	0.31	0.45	0.49	0.59	0.71	1.38	1.75
XS1	C	520	0.22	0.24	0.38	0.41	0.6	0.8	1.58	1.86
LEW-REW	D	475	0.23	0.25	0.38	0.39	0.55	0.8	1.48	1.70
	E	422	0.24	0.27	0.39	0.44	0.65	1.1	1.56	1.83
	F	370	0.23	0.25	0.35	0.38	0.55	0.7	1.49	1.65
	H	269	0.28	0.31	0.42	0.46	0.6	0.8	1.39	1.64
	I	235	0.28	0.31	0.4	0.44	0.59	0.8	1.38	1.57
	J	178	0.34	0.37	0.6	0.7	1.4	2	1.98	2.06
	K	125	0.29	0.34	0.44	0.48	0.79	1.23	1.54	1.66
5/14/91	01	15	-	-	0.028	-	-	-	-	-
RM 468.2	05	138	0.28	0.31	0.46	0.49	0.75	2	1.56	1.75
MRX2	06	172	0.28	0.31	0.41	0.44	0.65	0.9	1.45	1.57
REW-LEW	07	193	0.27	0.29	0.38	0.39	0.5	0.69	1.31	1.44
	08	230	0.27	0.31	0.39	0.41	0.65	1.2	1.46	1.52
	09	260	0.27	0.3	0.39	0.45	0.7	1.1	1.55	1.67
	10	295	0.27	0.3	0.39	0.4	0.55	0.7	1.36	1.48
	11	305	0.28	0.3	0.38	0.4	0.55	0.66	1.36	1.43
	12	340	0.28	0.32	0.45	0.49	0.55	0.7	1.31	1.75
	13	361	0.25	0.29	0.4	0.45	0.6	0.8	1.44	1.80
	14	395	0.22	0.24	0.34	0.36	0.5	0.67	1.44	1.64
	15	427	0.23	0.24	0.36	0.39	0.55	0.9	1.51	1.70
	16	454	0.23	0.26	0.38	0.39	0.55	0.8	1.45	1.70
	17	487	0.23	0.25	0.36	0.39	0.55	0.7	1.48	1.70
	18	502	0.22	0.24	0.32	0.36	0.59	0.9	1.59	1.64
	19	531	0.19	0.22	0.28	0.31	0.42	0.51	1.39	1.63
	20	565	0.006	0.02	0.24	0.29	0.52	0.7	7.08	48.33
	21	598	0.21	0.23	0.29	0.32	0.48	0.7	1.46	1.52
	22	620	-	-	0.018	0.024	-	-	-	-

Clarks Ferry Site, Trip 2

<i>Location</i>		<i>Dist. (ft)</i>	<i>Characteristics of Bed Material Particle Size (mm)</i>							
			<i>d₁₀</i>	<i>d₁₆</i>	<i>d₅₀</i>	<i>d₆₀</i>	<i>d₈₅</i>	<i>d₉₅</i>	<i>σ</i>	<i>U</i>
10/19/91	A	2015	0.13	0.16	0.25	0.28	0.44	0.60	1.66	2.15
RM 468.3	B	1921	0.23	0.26	0.37	0.39	0.5	0.65	1.39	1.70
XSB	C	1824	0.24	0.26	0.42	0.48	0.63	0.8	1.56	2.00
LEW-REW	D	1727	0.23	0.25	0.36	0.4	0.55	0.75	1.48	1.74
	E	1627	0.22	0.24	0.35	0.36	0.5	0.7	1.44	1.64
	F	1524	0.23	0.25	0.37	0.41	0.6	0.85	1.55	1.78
	G	1424	0.19	0.22	0.38	0.41	0.61	1	1.67	2.16
	H	1322	0.21	0.22	0.28	0.31	0.45	0.59	1.44	1.48
	J	1128	0.29	0.33	0.48	0.5	0.63	0.8	1.38	1.72
	K	1023	0.23	0.25	0.4	0.44	0.65	0.85	1.61	1.91
	L	925	0.25	0.28	0.42	0.46	0.65	0.82	1.52	1.84
	M	829	0.25	0.27	0.38	0.41	0.6	1	1.49	1.64
	N	724	0.26	0.3	0.42	0.49	0.9	2.5	1.77	1.88

APPENDIX IV.

**AMBIENT WATER LEVELS AND AIR AND WATER TEMPERATURES
AT ALL STUDY SITES**

**McEver's Island Site
(NA)**

Kamspville Site, Trip 1

Date	Time	Temperature				Water surface stage* (ft)
		Air (°F)	Surface water (°C)	Under water measured by		
				S4/040 (°C)	S4/071 (°C)	
10/11/90	09:00					2.20
	10:00					2.24
	13:46					2.40
	17:47					2.54
10/12/90	09:45					2.78
	12:39					2.98
	13:35			14.6	14.5	
	13:49			14.6	14.5	
	14:28		18.0			3.10
	15:30	67.1	17.0			3.14
10/13/90	17:00	59.0	17.0			3.24
	09:32				13.5	
	09:45	58.1	15.5			3.46
	09:56				13.4	
	10:00				13.4	
	10:53	61.7	16.0			3.50
	11:09			13.4	13.4	
	11:58	64.4	16.0			3.48
	13:42	66.2	17.0			3.48
	15:22			13.5	13.6	
	15:33	68.9	16.0			3.50
	16:25			13.5	13.6	
	17:12	65.3				3.46
	10/14/90	07:20	51.8	14.0		
09:30		60.8	15.0			3.56
10:18					12.4	
10:35		61.7	15.5			3.60
10:57				12.3		
11:43					12.4	
12:26				12.4	12.4	
12:51		73.4	16.0			3.58
13:30				12.5	12.6	
15:02		71.6	16.0			3.60
15:30				12.6	12.7	
15:45		67.1	16.0			

Kamspville Site, Trip 1 (Concluded)

Date	Time	Temperature				Water surface stage* (ft)
		Air (°F)	Surface water (°C)	Under water measured by		
				S4/040 (°C)	S4/071 (°C)	
10/15/90	15:59			12.6	12.7	
	16:07	66.2	16.0			3.52
	16:38			12.6	12.7	
	17:31		16.0			3.54
	09:50			12.9	13.0	
	09:53		15.0			3.66
	10:33	60.0	15.0			3.64
	10:50	58.0	16.0			3.66
	12:08			13.3	13.2	
	13:25	58.5	16.0			3.68
	14:41					3.64
	14:52			13.6		
	15:12			13.7	13.7	
	16:02	67.0	16.0			3.68
	17:30	64.0	15.0			3.68
10/16/90	09:22	59.0	15.5			3.72
	10:28			14.1	14.1	
	10:49	63.0	16.0			3.72
	11:56	66.0	17.0			3.74
	12:48	67.0	17.0			3.76
	14:44	74.5	17.0			3.76
	15:46	75.0	18.0			3.80
	16:21			14.6	14.7	
	16:56	73.0	18.0			3.80
	18:00	76.0	18.0			3.84
	09:15	73.5	17.5			3.90
	10:26			14.8	14.8	
10/17/90	11:14			14.8	14.8	
	11:28	73.5	17.5			3.90
	14:06	73.5	18.0			3.92

*water stage data were taken from a staff gage installed by ISWS for these field trips

Kampsville Site, Trip 2

<i>Date</i>	<i>Time</i>	<i>Temperature</i>		<i>Water surface stage*</i> (ft)
		<i>Air</i> (°F)	<i>Surface water</i> (°C)	
8/12/91	06:20			1.90
8/13/91	09:00			2.00
	11:40			2.00
	12:10	84.0	22.2	2.00
	18:40			1.94
8/14/91	07:00			2.12
8/15/91	17:00			1.94
	18:40			1.92

*water stage data were taken from a staff gage installed by ISWS for these field trips

Apple River Island Site

Date	Time	Temperature				Water Surface stage (m)
		Air (°C)	Water near shore (°C)	Water in channel		
				S4/040 (°C)	S4/071 (°C)	
5/18/90	14:34	20.5				
5/19/90	9:55				15.3	
	11:20				15.2	
	11:40				15.1	
	11:56				15.1	
	14:34	18.0	16.1			0.30
5/20/90	7:54	12.0	15.0			0.27
	10:55	11.0	15.0			0.29
	11:27			14.9		
	12:08	12.0	15.3			0.30
	12:36			14.8		
	15:33			14.6	14.9	
	17:56	11.5	15.0			0.33
5/21/90	8:26	10.5	13.9			0.35
	10:06			13.5	13.8	
	10:20					
	11:00			13.5	13.8	

Apple River Island Site (Concluded)

Date	Time	Temperature				Water Surface stage (m)
		Air (°C)	Water near shore (°C)	Water in channel		
				S4/040 (°C)	S4/071 (°C)	
5/22/90	11:10	13.0	14.4			
	12:40	15.0	14.4			0.35
	14:19			13.6		
	14:37			13.6	13.8	
	14:55			13.6	13.8	
	15:30	15.0	14.4			0.37
	16:50	16.0	14.7			0.38
	9:10	12.0	13.9			0.43
	10:09			13.6	13.8	
	11:00	15.0	15.3			0.43
5/23/90	13:40	18.0	15.6			0.44
	15:01	20.5	15.6			0.45
	16:30	20.0	15.6			0.45
	17:08			14.3	14.5	
	17:28			14.4	14.6	
	18:06			14.4	14.6	
	19:49			14.6	14.8	
	6:40	12.0	15.0			0.47
	6:52			14.0		
	8:45	14.0	15.0			0.48
5/24/90	10:05	15.0	15.0			0.48
	13:05	16.5	15.0			0.49
	14:09	17.0	15.3			0.50
	15:05	17.0	15.3			0.51
	16:13			14.4		
	18:00	17.0	15.0			0.52
	7:28					0.57
	8:35					0.57

Goose Island Site, Trip 1

Date	Time	Temperature				Water Surface stage (m)
		Air (°C)	Water near shore (°C)	Water in channel		
				S4/040 (°C)	S4/071 (°C)	
8/24/90	9:19	26.0	26.0			0.26
	10:16	28.0	26.0			0.24
	10:51			25.6	25.7	
	11:05	28.5	26.0			0.24
	12:08	29.5	26.0			0.21
	13:19	31.0	26.5			0.21
	13:42			25.6	25.8	
	13:54			25.6	25.9	
	14:16			25.7	25.9	
	14:33	31.0	26.5			0.21
	15:13	31.5	26.8			0.20
	16:19	31.5	27.0			0.19
	16:25	31.5	27.0			0.19
	16:39				26.1	
	18:07	31.0	27.0			
	18:55	30.0	26.0			0.18
8/25/90	7:25	25.0	25.0			0.19
	9:30	27.0	25.5			0.20
	10:35	27.5	26.0			0.20
	11:19			25.8	26.0	
	11:44	28.0	26.0			0.20
	12:15			25.8	27.0	
	12:24			25.8	26.0	
	12:31	29.0	27.0			
	13:51	29.5	27.0			0.19
	14:16	29.5	27.0			0.19
	15:06	30.5	27.0			0.20
	15:45			26.0	26.2	
	16:00	30.5	27.0			0.20
8/26/90	9:08		26.0			
	9:52	29.0	26.0			0.19
	11:00	30.5	26.5			0.19
	11:46			25.8	26.1	
	12:56	32.0	27.0			0.18
	13:27			25.9	26.1	

Goose Island Site, Trip 1 (Concluded)

Date	Time	Temperature				Water Surface stage (m)
		Air (°C)	Water near shore (°C)	Water in channel		
				S4/040 (°C)	S4/071 (°C)	
8/27/90	14:13	33.0	28.0			0.20
	14:21			26.0		
	15:29	34.0	28.0			0.20
	9:00		26.0			0.36
	9:37	30.0	26.0			0.36
	10:12	31.0	26.5			0.36
	11:50	33.0	27.0			0.39
	13:31	35.5	27.0			0.41
	18:05	35.0	27.0			0.43

Goose Island Site, Trip 2

Date	Time	Air (°C)	Temperature						Water surface stage (m)
			Water near shore (°C)	Water in channel					
				S4/40 (°C)	S4/151 (°C)	S4/834 (°C)	S4/832 (°C)	S4/071 (°C)	
7/16/91	15:30								0.55
	16:30								0.55
	17:00								0.55
7/17/91	12:30								0.55
	15:00	33.3							0.52
	16:50	35.0							0.52
7/18/91	7:45	27.8							0.49
	9:00								0.49
	10:42			27.4	27.7	27.3			
	12:26				27.8	27.5			
	11:00	29.4	29.0						0.49
	12:36	31.7	29.0						0.49
	13:54	32.2	29.0						0.49
	14:17			28.0	27.6	27.9	28.0	28.3	
	15:07	32.8	30.0						0.48
	16:16	32.8	30.0						0.48

Goose Island Site, Trip 2 (Continued)

		Temperature							Water surface stage (m)	
		Air (°C)	Water near shore (°C)	Water in channel						
Date	Time			S4/40 (°C)	S4/151 (°C)	S4/834 (°C)	S4/832 (°C)	S4/071 (°C)		
	17:23 18:07			28.3	27.9	28.2				
7/19/91	9:20	27.8	29.0						0.42	
	10:17	28.9	29.0						0.41	
	11:03					27.9				
	11:20	30.0	29.0						0.40	
	13:08	31.9	29.0						0.39	
	16:00	33.3	29.5						0.34	
	16:24					28.4		28.6		
	16:33					28.3		28.6		
	17:50	32.5	29.0						0.30	
	18:05					28.4				
7/20/91	6:15	25.6	29.0						0.30	
	7:55	25.8	29.0						0.32	
	8:09				27.8	28.1				
	8:19				27.8	28.1				
	9:06	27.8	29.0						0.33	
	10:41	29.4	29.0						0.34	
	11:39				27.9	27.6	27.8			
	11:55				27.9	27.6	27.8			
	13:00	31.7	31.0						0.35	
	13:31				27.9	27.6	27.8			
	16:24	32.8	31.0						0.35	
	16:56				28.3	28.0	28.2			
	7/21/91	9:30	30.6							0.30
		12:51	32.8	32.0						0.25
13:08				28.7	28.3	28.2	28.1	28.9		
14:21		32.5							0.22	
14:57				28.9	28.4	28.2	28.3	29.1		
15:11		32.5							0.18	
16:22		33.6							0.77	
17:33		34.4							0.76	
7/22/91	8:00	28.9	29.0						0.79	
	10:12	31.1	30.0						0.79	

Goose Island Site, Trip 2 (Continued)

		Temperature							Water surface stage
		Air	Water near shore	Water in channel					
				S4/40	S4/151	S4/834	S4/832	S4/071	
Date	Time	(°C)	(°C)	(°C)	(°C)	(°C)	(°C)	(°C)	(m)
7/23/91	10:34			28.8	28.4	28.1	28.3		
	12:00	32.8	32.0						0.80
	12:11			28.9	28.5	28.2	28.3	29.1	
	13:00	33.9	32.0						0.80
	13:16			29.0	28.6	28.3	28.5	29.2	
	13:20			29.1	28.6	28.3	28.5	29.2	
	13:24			29.1	28.6	28.3	28.5	29.2	
	14:00			29.1	28.6	28.3	28.5	29.3	
	14:10	34.4	32.0						0.79
	15:00	35.0	32.0						0.77
	17:10	34.4	32.0						0.76
	9:45	25.6	30.0						0.66
	10:57	27.2	30.0						0.67
	12:00								0.73
	13:15								0.76
	14:00	27.8	30.0						0.76
	14:12			29.1	28.8	28.5	28.6	29.4	
	14:20			29.2	28.7	28.5	28.6	29.4	
	15:15	28.9	30.0						0.79
	15:55			29.2	28.8	28.6	28.7	29.5	
15:59			29.2	28.9	28.6	28.7	29.5		
16:18	28.9	31.0						0.84	
16:24			29.2	28.8	28.5	28.7			
17:15	28.9	31.0						0.85	
7/24/91	7:00								0.87
	8:12	18.9							0.86
	8:25			28.7	28.3	28.0	28.1		
	9:14			28.7	28.2		28.1		
	9:58			28.7	28.2		28.1	28.9	
	10:22	21.1							0.85
	10:45								0.82
	10:55								0.82
	11:47								0.79
	12:13			28.6	28.2		28.1	28.8	
	12:29								0.79
	13:44			28.6	28.2		28.1	28.8	

Goose Island Site, Trip 2 (Concluded)

Date	Time	Air (°C)	Water near shore (°C)	Temperature					Water surface stage (m)	
				Water in channel						
				S4/40 (°C)	S4/151 (°C)	S4/834 (°C)	S4/832 (°C)	S4/071 (°C)		
	13:57									0.79
	14:48			28.6	28.2		28.1	28.8		
	15:43			28.6	28.2		28.1	28.8		

Clarks Ferry Site, Trip 1

Date	Time	Temperature							Water surface stage* (ft)
		Air (°F)	Surface water (°C)	Under water measured by					
				S4/151 (°C)	S4/834 (°C)	S4/832 (°C)	S4/483 (°C)	S4/071 (°C)	
5/16/91	10:39								2.32
	11:59								2.32
	12:08			20.9		20.1			
	12:23			21.3		20.1			2.36
	12:59								
	13:27			20.4		20.2			
	13:59								2.38
	14:53								2.38
	16:51								2:40
5/17/91	10:00								2:48
	11:06								2:48
	11:58								2:48
	12:26			21.0	20.4	20.7	21.0	21.1	
	13:04	79.5	25.0						
	15:04			21.3	20.8	21.1	21.4	21.5	
	15:35	81.0							2.50
	16:32		21.5	20.9	21.3	21.5	21.6		
	17:45		21.4	20.9	21.3	21.5	21.6		
5/18/91	11:03	52.5							3.00
	12:17	52.5	19.0						3.02
	13:17	53.0	19.0						3.02
	14:50	55.0	19.5						3.04
	16:16	55.0	19.5						3.08

Clarks Ferry Site, Trip 1 (Continued)

Date	Time	Temperature							Water surface stage* (ft)
		Air (°F)	Surface water (°C)	Under water measured by					
				S4/151 (°C)	S4/834 (°C)	S4/832 (°C)	S4/483 (°C)	S4/071 (°C)	
5/19/91	08:25	55.0	19.0						
	10:07			17.9	17.3	17.8	18.4		
	10:30	61.0	20.5						2.98
	11:42			18.0	17.4	17.8	18.4	18.5	
	11:45	64.0	21.0						2.98
	12:53	66.0	21.0						2.98
	14:21	68.0	22.0						2.98
	15:14	69.0	22.0						3.02
	16:29								3.04
	16:34			18.3	17.7	18.1	18.7	18.8	
	17:08	68.0	21.0						3.06
5/20/91	09:10	61.0	19.0						3.10
	10:57	67.0	21.0						3.10
	11:35			17.5	17.0	17.4	17.9	18.0	
	12:20	69.0	21.0						3.10
	12:24			17.6	17.0	17.5	18.0	18.1	
	13:00	70.5	22.0						3.12
	14:06	73.5	22.0						3.14
	15:15	75.0	22.5						3.16
	15:49			18.1	17.5	18.0	18.7	18.7	
	16:00	76.0	22.0						3.16
5/21/91	09:10			18.3	16.9	18.1	18.4	18.5	
	09:37				16.9	18.1	18.4		
	09:42	74.5	21.0						3.25
	10:30				16.9	18.2	18.6		
	10:46	75.0	21.0						3.25
	10:49				16.9	18.2	18.6		
	11:33					18.3	18.7		
	11:49	75.0	21.0						3.25
	12:13					18.4	18.8		
	12:38					18.4	18.8		
	12:45	76.0	21.5						3.25
	13:31					18.6	19.0		
	14:04	76.0	22.0						3.28
	15:01	77.0	22.0						3.28
	16:09				19.0	19.0	19.5	19.6	
	16:25	78.0	22.0						3.28

Clarks Ferry Site, Trip 1 (Concluded)

Date	Time	Temperature							Water surface stage* (ft)
		Air (°F)	Surface water (°C)	Under water measured by					
				S4/151 (°C)	S4/834 (°C)	S4/832 (°C)	S4/483 (°C)	S4/071 (°C)	
5/22/91	08:28	74.0							3.28
	09:49	76.0							
	09:54				18.0	18.9	19.0	19.0	
	10:30	75.0	22.0						
	10:55				18.1	18.9	19.1	19.1	
	11:33	77.0	23.0						
	12:55	79.0							
	13:47				18.5	19.2	19.4	19.4	
	14:16	80.0	23.0						
	15:03	81.0							
	16:03	82.0	25.0						
	16:58	82.0	24.0						
5/23/91	08:50		22.0						

*water stage data were taken from a staff gage installed by ISWS for these field trips.

Clarks Ferry Site, Trip 2

Date	Time	Temperature						Water surface stage* (ft)
		Air (°F)	Surface water (°C)	Under water measured by				
				S4/040 (°C)	S4/834 (°C)	S4/151 (°C)	S4/832 (°C)	
10/17/91	07:34			12.0				
	07:50		14.0					3.80
	09:21	54.0	18.0					3.78
	11:22	54.0	22.0					3.80
	11:44			11.9	11.9	11.5	11.4	
	11:45			11.9	10.9	11.5	11.4	
	13:22	60.0	25.0					3.80
	17:06				11.6	12.0	11.9	
	18:56			12.7	11.7	12.0	11.9	
	20:14			12.7	11.6	12.0	11.9	
	20:20			12.7	11.6	12.0	11.9	
	20:51			12.7	11.7	11.9	11.8	
10/18/91	07:17			12.1	11.0	11.1	11.0	
	07:30	52.0	5.0					3.75
	07:43			12.1	11.0	11.1	11.0	

Clarks Ferry Site, Trip 2 (Concluded)

Date	Time	Temperature							Water surface stage* (ft)
		Air (°F)	Surface water (°C)	Under water measured by					
				S4/151 (°C)	S4/834 (°C)	S4/832 (°C)	S4/483 (°C)	S4/071 (°C)	
10/18/91	08:26			12.0	10.9	11.1	10.9		
	09:20	52.0	15.0					3.75	
	09:57			10.9	10.7	11.1	10.9		
	10:07			11.8	10.7	11.1	11.0		
	11:21	57.0	20.0					3.75	
	11:27			11.8	10.7				
	12:32			11.8	10.8	11.4	11.2		
	13:18	59.0	20.0					3.80	
	15:30							3.80	
10/19/91	07:00	49.0	0.0					3.78	
	09:00	50.0	7.0					3.78	
	10:15			10.9	9.9	10.6	10.5		
	11:00	52.0	11.0					3.78	
	12:08			10.9	10.0	10.8	11.7		
	12:53	57.0	13.0					3.78	
	12:58			11.0	10.2	11.0	10.8		
	13:45			11.1	10.2	11.0	10.9		
	14:04			11.1	10.3	11.1	10.9		
	14:54			11.3	10.4	11.2	11.0		
	15:01	55.0	11.0					3.80	
	17:04	53.0	11.0					3.84	
	17:31			11.5	10.6	11.2	11.1		
10/20/91	06:55			11.2	10.3	10.7	10.6		
	07:06			11.2	10.3	10.7	10.6		
	07:30	49.0	4.0					3.86	
	09:06	50.0	7.0					3.86	
	09:33			11.1	10.2	10.7	10.6		
	10:53	52.0	11.0					3.86	
	12:20			11.1	10.0	10.9	10.9		

*water stage data were taken from a staff gage installed by ISWS for these field trips.

APPENDIX V.

**MEASURED WATER DISCHARGE, COMPUTED AVERAGE
VELOCITY, AND WATER DEPTH FOR ALL STUDY SITES**

McEver's Island Site

<i>Date</i>	Q_w <i>cms</i>	\bar{V} <i>m/s</i>	\bar{D} <i>m</i>
5/17/89	212	0.27	3.37

Kampsville Site

<i>Trip 1</i>			
<i>Date</i>	Q_w <i>cms</i>	\bar{V} <i>m/s</i>	\bar{D} <i>m</i>
10/10/90	413	0.36	3.44
10/15/90	772	0.58	3.64
10/18/90	817	0.61	3.91

<i>Trip 2</i>			
8/8/91	329	0.29	3.51

Apple River Island Site

<i>Date</i>	Q_w <i>cms</i>	\bar{V} <i>m/s</i>	\bar{D} <i>m</i>
5/22/90	1537.4	0.81	5.16

Goose Island Site

<i>Date</i>	<i>Trip 1</i>		
	<i>Q_w</i> <i>cms</i>	\bar{V} <i>m/s</i>	\bar{D} <i>m</i>
8/29/90	2856	1.13	6.04
<i>Trip 2</i>			
7/20/91	1808	0.83	5.42
7/24/91	1880	0.84	5.56

Clarks Ferry Site

<i>Date</i>	<i>Trip 1</i>		
	<i>Q_w</i> <i>cms</i>	\bar{V} <i>m/s</i>	\bar{D} <i>m</i>
5/14/91	2351	0.83	4.41
5/22/91	2072	0.78	4.18
5/23/91	2428	0.85	4.36
<i>Trip 2</i>			
10/19/91	673	0.32	3.40

APPENDIX VI.
AMBIENT SUSPENDED SEDIMENT CONCENTRATIONS
AT ALL STUDY SITES

**McEver's Island Site
(NA)**

Kampsville Site, Trip 1

<i>Sampling date</i>	<i>River mile</i>	<i>Station ID</i>	<i>Dist. (m) (REW-LEW)</i>	<i>Concentration (mg/L)</i>
10/18/90	35.2	C1/2	300	206.0*
		C3	278	470.0*
		C4	259	357.2*
		C5	243	387.4
		C6	217	347.5*
		C7	198	259.5*
		C8	178	263.6*
		C9	160	339.9
		C10	137	307.7
		C11	124	237.6*
		C12	99	229.7*
		C13	80	372.8*
		C14	57	320.6
		C15	37	329.7
		C16	20	318.0
10/19/90		B13	139	246.8*
		B14	122	259.2
		B15	101	285.3
		B16	82	164.5

Kampsville Site, Trip 2

<i>Sampling date</i>	<i>River mile</i>	<i>Station ID</i>	<i>Dist. (ft) (REW-LEW)</i>	<i>Concentration (mg/L)</i>
8/08/91	35.4	A	50	107.9*
		B	148	158.6
		C	260	132.4
		D	355	84.6
		E	460	88.9
		F	540	122.0
		G	652	128.7
		H	752	78.5
		I	847	73.4
		J	952	171.6

*algae grown in sample bottles; therefore, results were used as a reference value only.

Apple River Island Site (NA)

Goose Island Site, Trip 1 (NA)

Goose Island Site, Trip 2

<i>Sampling date</i>	<i>River mile</i>	<i>Station ID</i>	<i>Dist. (ft) (REW-LEW)</i>	<i>Concentration (mg/L)</i>
07/20/91	319.3	t-40	40	146.4
		t-100	100	130.9
		t-160	160	129.7
		t-217	217	129.8
		t-277	277	137.9
		t-340	340	122.8
		t-398	398	123.4
		t-464	464	119.1
		t-520	520	127.5
		t-580	580	122.1
		t-645	645	115.6
		t-702	702	119.4
		t-757	757	104.1
		t-820	820	121.1
		t-897	897	130.5
		t-942	942	111.0

Goose Island Site, Trip 2 (Continued)

<i>Sampling date</i>	<i>River mile</i>	<i>Station ID</i>	<i>Dist. (ft) (REW-LEW)</i>	<i>Concentration (mg/L)</i>
07/20/91	319.3	t-1061	1061	117.1
		t-1185	1185	127.6
		t-1240	1240	129.5
		t-1290	1290	147.6
		t-990	990	116.5
		t-1100	1100	116.6
07/21/91	319.8	G-20	37	89.5
		G-50	67	98.6
		G-110	127	80.4
		G-165	182	82.5
		G-231	248	72.1
		G-290	307	74.0
		G-349	366	83.9
		G-407	424	66.7
		G-467	484	67.3
		G-529	546	72.8
		G-591	608	71.1
		G-651	668	94.7
		G-710	727	69.2
		G-768	785	70.7
		G-830	847	75.5
		G-887	904	69.4
		G-946	963	73.4
07/24/91	319.3	t-17	17	113.0
		t-35	35	83.9
		t-55	55	80.2
		t-75	75	69.8
		t-96	96	62.6
		t-115	115	110.7
		t-135	135	99.5
		t-157	157	101.4
		t-175	175	135.9
		t-195	195	78.5

Goose Island Site, Trip 2 (Concluded)

<i>Sampling date</i>	<i>River mile</i>	<i>Station ID</i>	<i>Dist. (m)</i> <i>(REW-LEW)</i>	<i>Concentration (mg/L)</i>
07/24/91	319.3	t-215	215	116.6
		t-233	233	115.3
		t-257	257	113.3
		t-274	274	114.7
		t-295	295	116.4
		t-314	314	134.2
		t-333	333	133.9
		t-355	355	143.3
		t-373	373	134.5
		t-391	391	247.8

Clarks Ferry Site, Trip 1

<i>Sampling date</i>	<i>River mile</i>	<i>Station ID</i>	<i>Dist. (ft)</i> <i>(LEW-REW)</i>	<i>Concentration (mg/L)</i>
05/23/91	468.1	A1	75.46	118.4
		B1	180.44	130.0
		C1	377.29	126.1
		D1	551.17	121.2
		E1	738.18	115.6
		F1	849.73	120.0
		G1	1020.33	122.1
		H1	1181.09	125.1
		I1	1351.69	126.1
		J1	1525.57	126.5
		K1	1673.21	130.0
		L1	1853.65	128.7
		M1	1985.11	110.5

Clarks Ferry Site, Trip 1 (Concluded)

<i>Sampling date</i>	<i>River mile</i>	<i>Station ID</i>	<i>Dist. (ft)</i> <i>(LEW-REW)</i>	<i>Concentration (mg/L)</i>
05/14/91	468.2	1	42.65	136.5
		2	141.08	136.0
		3	239.50	114.1
		4	354.33	118.1
		5	446.19	114.7
		6	557.74	129.1
		7	626.63	113.8
		8	748.02	105.4
		9	846.45	110.9
		10	961.28	106.2
05/14/91		11	994.08	123.2
		12	1108.91	109.5
		13	1177.81	104.2
		14	1289.36	105.5
		15	1394.34	106.3
		16	1482.92	120.9
		17	1591.19	122.5
		18	1640.40	113.0
		19	1735.54	115.8
		20	1847.09	119.1
		21	1955.36	141.9
		22	2027.54	138.4
05/22/91	468.3	A3	124.67	130.4
		B3	239.50	128.6
		C3	446.19	127.0
		D3	580.70	125.5
		E3	764.43	122.0
		F3	928.47	124.3
		G3	1076.10	125.4
		H3	1289.36	131.7
		I3	1407.47	136.3
		J3	1581.35	128.8
		K3	1768.35	124.3
		L3	1932.39	122.5
		M3	2057.06	98.0

APPENDIX VII.
TRAFFIC CHARACTERISTICS AT ALL STUDY SITES

McEver's Island Site

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
5/16/89	R.W. Naye	1020	2	N	22.9	7.3	11	3x3		2.74	2.20	120	u
	Evelyn C.	2200	2	N	25.9	10.7	1	1x1		0.76		130	d
5/17/89	Mary Ellen	800	2	Y	17.7	6.1	6	2x3		2.74	1.22	150	u
	Elaine Jones	5000	2	Y	47.0	12.2	8	2x4		2.74	2.00	120	u
	Bill McCormick	3200	2	Y	45.3	10.5	16	3x5+1		2.74	2.55	130	d
	Nicolas Duncan	1530	2	N	39.0	8.5	15	3x5		2.74	1.39	130	u
5/18/89	Mobil Leader	5000	2	Y	47.0	13.5	6	2x3		2.74	2.40	140	u
	Reliance	5600	2	Y	38.7	12.2	15	3x5		2.08	2.27	130	u
	Cooperative Vanguard	3700	2	N	51.2	12.2	15	3x5		2.74	2.64	160	d
	Marvin E. Norman	1800	2	N	31.1	10.4	15	3x5		0.76	2.59	130	u
	Illini	1600	2	N	24.4	8.5	11	3x4-1		2.74	2.30	160	d
5/19/89	Thurston B. Norton	4200	2	N	45.7	10.7	13	1+3x4		2.74	2.10	150	d
	Clarence G. Frame	4100	2	Y	43.9	10.7	15	3x5		2.74	2.75	160	d

Kampsville Site, Trip 1

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
10/11/90	Mallard	1650	2	N	26.8	9.1	2	1x2	chemical	0.61	3.83	122	d
	Nicolas Duncan	1530	2	N	39.0	8.5	9	3x3	grain	1.32	2.88	155	d
	Bill Gee	2800	2	Y	36.9	10.1	3	2x1+1	coal	1.31	4.76	140	d
10/12/90	Mr. Aldo	5600	2	Y	44.2	14.6	14	2x1+3x4	grain	2.74	2.78	130	d
	Floyd H. Blaske	5000	2	Y	51.8	12.2	12	3x4	grain	1.63	2.18	115	u

Kampsville Site, Trip 1 (Concluded)

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
10/13/90	Marvin E. Norman	1800	2	N	31.1	10.4	16	3x5+1	grain	0.61	1.69	115	u
	Luke Burton	4200	2	Y	43.9	10.7	3	1x3	mixed	2.74	2.93	138	u
	Sugarland	3375	3	N	42.1	12.8	12	3x4	grain	2.29	1.88	170	u
	William C. Norman	1800	2	N	33.5	10.4	12	3x4	grain	2.74	2.90	138	d
	Frank H. Peavey	3800	2	N	42.7	11.6	23	4x5+3	grain	1.17	1.75	150	u
	Conti Karla	3060	2	N	34.8	10.5	16	3x5+1	grain	2.34	1.70	145	u
10/14/90	Margaret O.	5600	2	Y	42.1	13.4	10	2x5	grain	2.53	2.75	150	u
	Lydia E. Campbell	4200	2	Y	43.9	10.7	3	1x3	grain	2.74	3.24	180	u
	Mr. Paul	5600	2	Y	44.2	14.6	8	2x4	chemical	1.68	2.76	155	d
	Rambler	2000	2	N	27.4	9.1	12	3x4	grain	2.74	2.48	138	d
	Mr. Lawrence	5600	2	Y	44.2	14.6	15	3x5	grain	1.75	2.56	165	u
	Mallard	1650	2	N	26.8	9.1	7	3x2+1	mixed	2.13	2.68	175	u
	Charles Lehman	5600	2	Y	44.2	14.6	13	1+3x4	coal	2.74	1.85	145	u
	Nicolas Duncan	1530	2	N	39.0	8.5	9	3x3	grain	2.74	1.52	130	u
	Jeffboat	6000	2	Y	44.2	14.6	15	3x5	grain	2.74	1.84	115	u
	Mary Ann	2250	2	N	30.5	9.1	15	3x5	grain	0.61	1.90	105	u
10/15/90	Ardyce Randall	5600	2	Y	44.2	14.6	15	3x5	grain	2.74	2.36	155	d
	Mr. Paul	5600	2	Y	44.2	14.6	15	3x5	grain	1.61	2.25	130	u
	Exxon St. Louis	3800	2	N	42.7	13.4	4	2x2	petroleum	2.74	2.25	175	u
	Margaret O.	5600	2	Y	42.1	13.4	12	3x4	cargo	2.03	3.83	130	d
	Mr. Lawrence	5600	2	Y	44.2	14.6	15	3x5	cargo	2.74	3.16	115	d
	A.L. Smith	1800	2	N	-	-	8	2x4	cargo	2.48	2.80	140	d
	Ste. Genevieve	1600	2	N	23.2	7.9	12	3x4	cargo	0.61	1.66	150	u
10/17/90	Nicole Brent	1400	2	N	22.9	7.9	2	1x2	chemical	2.74	2.86	150	u
	Frank H. Peavey	3800	2	N	42.7	11.6	5	1+2x2	cargo	2.74	3.05	170	d

Kampsville Site, Trip 2

Date	Name	Hp	Screws	Kort	Length (m)	Width (m)	No. of barges	Config	Type of barge hopper & chemical	Draft (m)	Speed (m/s)	Dist. (m)	Direction
8/13/91	Ranger	850	2	Y	21.3	6.1	5	2x2+1	hopper	2.74	1.90	190	d
	Dixie Patriot	3200	2	N	33.5	10.4	3	1x3		2.74	2.48	135	d
	Orleanian	4300	2	N	42.7	11.6	13	3x4+1			2.02	120	u
	Pat Breen	5600	2	Y	44.2	14.6	15	3x5		1.52	2.29	120	d
	Dixie Express	1700	2	N	26.2	8.5	2	1x2		1.52	3.40	140	d
	Jo Anne Stegbauer	3200	2	N	36.6	10.7	2	1x2	chemical			110	u
	Ste. Genevieve	200	2	N	12.2	4.6	11	2+3x3	empty		2.48	100	u
	Bob White	3600	2	N	40.5	10.5	9	3x3	closed hopper		1.37	205	d
8/14/91	Night-14-01						11	2+3x3			1.62	100	u
	Night-14-02						9	3x3	chemical		4.05	210	d
	Irving Crown	2400	2	N	31.4	9.1	7	3+2x2		2.74	1.59	180	u
	Gordon Jones	4200	2	N	44.8	11.7	15	3x5		2.74		130	d
	George W. Schamblin	1800	2	N	26.1	9.1	2	2x1		0.61	3.83	130	d
	Katherine L.	1600	2	N	31.1	8.5	2	1x2		0.61	3.21	160	d
	Thruston B. Morton	4200	2	N	45.7	10.7	12	3x4		1.52	2.18	160	u
	Julie White	1700	2	N	26.8	11.6	12	3x2+2x3			2.20	130	u
	Ranger	850	2	Y	21.3	6.1	1	1x1	empty		3.50	110	u
	Illini	1600	2	N	24.4	8.5	12	3x4			2.18	170	u
	Bronwynne Brent	5400	2	Y	42.7	12.8	6	2x3		0.61	2.32	140	d
	Sugarland	3375	3	N	42.1	12.8	1	1x1		0.61			u
	Frank Stegbauer	3200	2	N	39.6	10.7	1	1x1	chemical	0.61			d

Kampsville Site, Trip 2 (Concluded)

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
8/15/91	Bill McCormick	3200	2	Y	45.3	10.5	8	2x4		2.74	2.07		d
	Marvin E. Norman	1800	2	N	31.1	10.4	6	2x3			1.75	150	d
	Olmstead	5920	2	Y	42.1	13.4	15	3x5	coal		2.19	140	u
	Jack D. Wofford	5000	2	Y	51.8	12.2	15	3x5		2.74	2.22	140	u
	Dixie Express	1800	2	N	30.5	8.5	2	1x2		2.74	2.58	160	u
	Hal D. Miller	2400	2	N	32.9	9.8	2	1x2	work		2.33	150	d
	Jesse Brent	4300	2	N	36.6	12.2	2	2x1	hopper	1.52	3.72	180	d

Apple River Island Site

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
5/18/90	Mississippi Belle II												
	Yazoo	2550	3	N	32.9	9.2	15	3x5		1.85	1.43	220	u
	Cooperative Ambassador	3800	2	Y	48.8	12.2	15	3x5		2.67	2.13	275	u
	Christine Bailey	5200	2	N	42.7	11.6	15	3x5		2.74	3.29	245	d
5/19	Kathy Ellen	3800	2	N	46.0	10.6	10	3x3+1		2.32	1.83		u
	W.A. Kernan	5600	2	Y	44.2	14.6	16	3x5+1		0.61	2.00	220	u
	Hornet	4300	2	N	44.5	11.6	4	2x2		2.74	2.77	230	d
	Conti Bonnie	6000	2	Y	44.2	14.6	17	3x5+2		0.61	3.43	215	u
	Becky Lynn	5600	2	Y	42.7	12.8	16	3x5+1		1.52	2.84	215	u
	Twilight												
	Lexington	5600	2	Y	51.8	12.2	15	3x5		2.74	3.99	215	d

Apple River Island Site (Continued)

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
5/20/90	Philip M. Pfeffer	6140	2	Y	42.7	12.8	15	3x5		2.74	3.62	230	d
	Merlin Banta	2800	2	N	38.4	8.8	4			0.61	2.32	230	d
	Mississippi Belle II												
	Rusty Flower	4200	2	Y	42.7	12.8	16	3x5+1		1.18	7.38	250	d
	Tom Talbert	5600	2	Y	51.2	12.2	15	3x5		0.61	2.96	215	u
5/21/90	Twilight										3.41	230	u
	Julia Swain												
	Herman Pott	5600	2	Y	51.2	12.2	15	3x5		2.74	2.44	215	u
	Walter Brunson	4200	2	N	45.7	10.7	15	3x5		0.61	3.05	215	u
	Dell Butcher	5000	2	Y	51.8	12.2	15	3x5		2.74	4.33	230	d
5/22/90	Mississippi Belle II												
	Mary Gail	1200	2	N	19.8	7.3	4	2x2		0.61	3.30	230	u
	Julia Swain												
	T.S. Kunsman	4200	2	N	45.7	10.7	12	3x4		2.74	4.15	230	d
	Twilight												
5/22/90	D. Ray Miller	5600	2	Y	44.2	14.6	11	3x4-1		2.16	2.22	215	u
	Mississippi Belle II												
	Mary Gail	1200	2	N	19.8	7.3	4	2x2		2.74	3.96	230	d
	Trojan	1350	2	N	21.3	7.9	9	3x3		2.74	2.68	215	d
	Melinda Brent	1880	2	N	26.2	8.4	2	2x1	Super Jumbo	0.61	2.38	250	u
5/22/90	Twilight												
	Julia Swain												
	Cooperative Mariner	3700	2	N	51.2	12.2	12	3x4		2.74	4.66	230	d
5/22/90	Ed Renshaw	5600	2	Y	51.8	13.7	9	3x3		2.74	3.05	250	u

Apple River Island Site (Concluded)

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
5/23/90	Kevin Michael	5600	2	N	54.0	12.8	16	3x5+1		0.61	2.68	215	u
	Mississippi Belle II												
	Julia Swain												
	Twilight												
	Jack D. Wofford	5000	2	Y	51.8	12.2	2	1x2		2.74	2.87	215	u
	Trojan	1350	2	N	21.3	7.9	5	1+2x2		0.61	2.38	215	u

Goose Island Site, Trip 1

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
8/24/90	Sierra Dawn	5000	2	Y	50.0	12.2	11	2+3x3		2.74	2.72	320	d
	Dell Butcher	5000	2	Y	51.8	12.2	13	1+3x4		2.74	3.17	300	d
	William C. Norman	1800	2	N	33.5	10.4	16	3x5+1		0.61	1.83	320	u
	Normania	1800	2	N	27.4	9.1	16	3x5+1		0.61	1.26	320	u
	Dave Carlton	6000	2	Y	51.8	13.7	15	3x5		2.74	3.50	300	d
8/25/90	Hugh C. Blaske	5000	2	Y	51.8	12.2	15	3x5		2.60	1.88	310	u
	Teresa R. Beesber	4200	2	Y	35.4	10.4	15	3x5		2.74	3.58	280	d
	Trojan Warrior	2800	2	Y	33.5	10.4	4	2x2		2.74	1.42	320	u
	Hoosier State	4320	2	Y	45.7	14.6	13	1+3x4		0.61	2.83	310	u
8/26/90	Reliance	2800	2	N	50.9	11.1	15	3x5		2.74	3.03	320	d
	Kevin Michael	5600	2	N	54.0	12.8	15	3x5		2.74	2.91	310	d
	Sumac	1965	3	N	34.9	9.3	1	1x1	Buoy Tender	2.74	3.54	300	d
	Twin Cities	4200	2	Y	44.1	11.0	13	1+3x4		2.57	2.19	320	u
	Cooperative Vanguard	3700	2	N	51.2	12.2	15	3x5		0.61	2.22	320	u
8/27/90	Superior	3900	2	N	39.6	11.3	5	1+2x2		2.74	0.98	320	u
	Helen M. Clements	5100	3	N	42.7	13.7	15	3x5		2.60	2.36	320	d

Goose Island Site, Trip 2

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
7/18/91	Ardyce Randall	5600	2	Y	44.2	14.6	15	3x5	closed hopper	2.74	3.11	305	d
	Scarlet Knight	4200	2	N	42.7	12.8	15	3x5	closed hopper	2.74	3.20	305	d
	James F. Neal	6000	2	Y	44.2	14.6	15	3x5	closed hopper	2.74	4.05	305	d
	Helen M. Clements	5100	3	N	42.7	13.7	16	3x5+1	closed hopper	0.61	2.44	330	u
	Elizabeth Ann	1350	2	N	21.3		15	3x5	closed hopper	2.74	3.20	330	d
7/19/91	Frank T. Heffelfinger	3800	2	N	42.7	11.6	15	3x5	closed hopper jumbo	2.74	2.99	305	d
	Queen City	5600	2	Y	42.7	12.8	15	3x5	closed hopper	2.74	3.54	350	d
	Helen M. Clements	5100	3	N	42.7	13.7	15	3x5	closed hopper	2.74	2.83	310	d
	Frank T. Heffelfinger	3800	2	N	42.7	11.6	15	3x5	coal barge	2.74	2.38	350	u
	Cooperative Venture	3700	2	N	51.2	12.2	15	3x5	closed hopper	0.61	2.54	350	u
	Volunteer State	4320	2	Y	45.7	14.6	15	3x5	closed hopper	2.74	3.00	350	d
	No Name						15	3x5	closed hopper	2.74	3.46		d
	Night 1						9	3x3	chemical barge	0.61	1.75		u
	Night 2						6	3x2	barge	0.61	2.29		u
	G.R. Packet	4200	2	N	44.8	11.6	15	3x5	closed hopper	2.74	3.00	300	d
7/20/91	Prairie Dawn	5000	2	Y	50.0	12.2	15	3x5	closed hopper	2.74	2.68	310	d
	Prosperity	3800	2	N	51.2	12.2	15	3x5	closed hopper	0.61	1.93	310	u
	Clyde Butcher	5000	2	Y	51.8	12.2	15	3x5	closed hopper	2.74	3.62	350	d
	Lil Charley	1000	2	N	19.8	7.3	2	1x2	closed hopper	2.74	4.95	330	d
	C.W. Rushing	1200	1	N	32.3	10.4	1	1x1	barge	2.13	5.39	305	d
	Conti-Nan	4200	2	N	42.7	13.4	16	3x5+1	closed hopper	0.61	2.30	350	u
	Mary L.	4300	2	N	44.5	11.6	15	3x5	closed hopper	2.74	3.00	305	d

Goose Island Site, Trip 2 (Continued)

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
7/21/91	Cooperative Vanguard	3700	2	N	51.2	12.2	14	3x4+2		1.52	2.83	310	u
	Conti-Karla	3060	2	N	34.7	10.5	15	3x5	closed hopper	2.74	3.46	305	d
7/22/91	Cooperative Mariner	3700	2	N	51.2	12.2	15	3x5	closed hopper	2.74	2.89	315	d
	Hornet	4300	2	N	44.5	11.6	15	3x5	closed hopper	2.74	3.14	300	d
	Cooperative	3800	2	Y	48.8	12.2	15	3x5	closed hopper	1.32	2.83	330	u
	Ambassador												
	Eastern	3530	2	Y	50.9	11.1	15	3x5	closed hopper	0.61	1.55	380	u
	Sam M. Fleming	4100	2	Y	43.9	10.7	8	3x5	barge	2.74	2.67	300	u
7/23/91	Kevin Michael	5600	2	N	54.0	12.8	15	3x5	closed hopper	2.74	2.94	320	d
	A.M. Thompson	3800	2	N	43.3	10.4	15	3x5	closed hopper	2.74	2.86	330	d
	Susan Elizabeth	760	2	N	17.1	5.7	1	3x5	closed hopper	2.74		380	u
	Lil Charley	1000	2	N	19.8	7.3	1	1x1		2.74	4.95	300	u
	Badger	3800	2	N	45.7	10.7	15	3x5	closed hopper	2.74	3.62	310	d
	Kay D	1800	2	N	32.9	6.1	2	3x5		2.74	3.66	330	d
	Every-T	4300	2	N	42.7	11.6	16	3x5+1	closed hopper	0.61	2.32	320	u
	Robert Ingle	3600	2	Y	48.8	10.7	15	3x5	closed hopper	2.74	2.63	310	d
	Prairie Dawn	5000	2	Y	50.0	12.2	15	3x5	closed hopper	0.61	3.72	330	u

Goose Island Site, Trip 2 (Concluded)

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
7/24/91	G.R. Packet	4200	2	N	44.8	11.6	16	3x5+1		1.41	2.91	305	u
	Mary L	4300	2	N	44.5	11.6	16	3x5+1	closed hopper	0.61	2.34	320	u
	Dub Hollinger	2880	2	N	39.2	8.5	14	2x5+4	closed hopper	0.61	2.65	310	u
	C.W. Rushing	1200	1	N	32.3	10.4	1	1x1	closed hopper	2.74	2.68	320	u
	Dell Butcher	5000	2	Y	51.8	12.2	15	3x5	closed hopper	2.74	3.19	330	d
	Coral Dawn	5000	2	Y	50.0	12.2	15	3x5	closed hopper	0.61	2.23	320	u
	Teresa R. Beesecker	4200	2	Y	35.4	10.4	15	3x5	closed hopper	0.61	2.80	305	u
	Sirene	800	2	N	16.5	7.3	6	2x3	closed hopper	2.74	2.97	320	d
	Rusty Flavors	4200	2	Y	42.7	12.8	15	3x5	closed hopper	0.61	2.27	320	u

Clarks Ferry Site, Trip 1

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
5/16/91	C.W. Rushing (1)	1200	1	N	32.3	10.4	2	1x2	cargo	2.74	2.02	325	u
	Donnie Ray Jr. (1)	5600	2	Y	53.7	12.2	15	3x5	cargo	2.66	3.35	250	d
	Samantha (1)	1000	2	N	18.2	6.7	1	1x1	coal	2.74	3.66	270	d
	Samantha (2)	1000	2	N	18.2	6.7	0			2.74	2.61	270	u
5/17/91	Quad City Queen											250	d
	C.W. Rushing (2)	1200	1	N	32.3	10.4	1	1x1	cargo	1.52	2.02	270	d
	Jemco Towing						4	2x2	cargo	2.74	2.97	275	u
	T.S. Kunsman	4200	2	N	45.7	10.7	12	3x4	cargo	2.74	2.54	370	d
	Dell Butcher (1)	5000	2	Y	51.8	12.2	10	2x5	cargo	2.74	2.16	270	u

Clarks Ferry Site, Trip 1 (Continued)

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
5/18/91	William Earthman	4100	2	Y	43.9	10.7	4	2x2	chemical	1.52	2.54	250	u
	Lady Lone Star	760	2	N	23.8	7.3	0			2.74	2.98		u
5/19/91	Pearl B.	4400	2	N	42.7	9.1	12	3x4	cargo	2.74	2.87	250	d
	Conti-Afton	4200	2	N	42.7	13.4	15	3x5	cargo	2.74	3.88	300	d
	Jack D. Wofford	5000	2	Y	51.8	12.2	12	3x4	cargo	2.74	3.7	300	d
	Creole Belle	3900	2	N	39.6	11.3	16	3x5+1	empty	0.61	2.03	225	u
5/20/91	Donnie Ray Jr. (2)	5600	2	Y	53.7	12.2	15	3x5	cargo	2.74	3.00	225	u
	Sunflower (1)	825	3	N	16.8	6.71	1	1x1	cargo	0.61	5.59	250	d
	American Beauty(1)	5000	2	Y	51.8	13.7	15	3x5	cargo	0.61	3.23	275	u
5/21/91	Sierra Dawn	5000	2	Y	50	12.2	12	3x4	cargo	2.64	3.33	270	d
	Coop. Vanguard	3700	2	N	51.2	12.2	6	3x2	cargo	2.74	2.69	250	d
	Cindy J. Erickson	3900	2	N	36.6	11.6	15	3x5	cargo	0.61	2.37	250	u
	Frank H. Peavey	3800	2	N	42.7	11.6	12	3x4	cargo	2.74	3.28	275	d
	Helen M. Clements	5100	3	N	42.7	13.7	12	3x4	cargo	0.61	2.51	260	u
	Sunflowers (2)	825	3	N	16.8	6.71	1	1x1	cargo	1.52	5.6	225	d
	Dell Butcher (2)	5000	2	Y	51.8	12.2	12	3x4	cargo	2.74	3.24	300	d
	Hornet	4300	2	N	44.5	11.6	12	3x4	cargo	0.61	2.97	280	u
	Volunteer State	4320	2	N	45.7	14.6	15	3x5	cargo	0.61	3.51	250	u
	Enterprise Star						15	3x5	cargo	2.74	5.31	275	d

Clarks Ferry Site, Trip 1 (Concluded)

Date	Name	Hp	Screws	Kort	Length (m)	Width (m)	No. of barges	Config	Type of barge	Draft (m)	Speed (m/s)	Dist. (m)	Direction
5/22/91	Edward J. Hancock	4320	2	Y	45.1	10.4	13	3x4+1	cargo	.61	1.83	250	u
	Joe/Nut	5600	4	N	49.3	13.7	1			2.74	2.74	300	u
	Starfire	3200	2	N	47.6	10.7	10	1+3x3	cargo	1.89	1.98	250	u
	Conti-Karla	3060	2	N	34.7	10.5	16	3x5+1	cargo	0.74	2.00	275	u
	American Beauty(2)	5000	2	Y	51.8	13.7	3	1+2x1	cargo	1.52	5.18	300	d

Clarks Ferry Site, Trip 2

Date	Name	Hp	Screws	Kort	Length (m)	Width (m)	No. of barges	Config	Type of barge	Draft (m)	Speed (m/s)	Dist. (m)	Direction
10/17/91	C.W. Rushing	1200	1	N	32.3	10.4	2	2x1	hopper	1.52	3.98	220	d
	Evey-T	4300	2	N	42.7	11.6	13	1+3x4	empty	.61	2.41	260	u
	Sunflower (1)	825	3	N	16.8	6.7	1	1x1	empty	.61	4.25	185	d
	Evelyn C.	2200	2	N	25.9	10.7	5	1+2x2	Corp of Eng. work barge	2.74	1.92	220	d
	Sunflower (2)	825	3	N	16.8	6.7	1	1x1	hopper	2.74	3.13	210	u
	Conti-Nan (1)			N			15	3x5	hopper	2.74	2.41	260	d
	Night 1			N			1	1x1	work	2.74		250	u
	Night 2			N			1	1x1	hopper	1.52	4.25	230	u
	Night 3			N			6	3x2	work	2.74		230	d
10/18/91	Lady Lone Star	760	2	N	23.8	7.3	1	1x1	coal	2.74	2.38	200	d
	Lady Lone Star	760	2	N	23.8	7.3	0			2.74	3.4	260	u
	Kevin Michael	5600	2	N	54	12.8	12	3x4	closed hopper	2.74	2.31	245	d
	Deborah Valentine	4300	2	Y	47	12.2	15	3x5	closed hopper	2.74	2.14	210	d
	Volunteer State	4320	2	Y	45.7	14.6	4	2x2	closed hopper	2.74	4.25	185	d
	Sunflower (3)	825	3	N	16.8	6.7	1	1x1	closed hopper	.61	4.25	230	d
	Frank Stegbauer	3200	2	N	39.6	10.7	3	1+2x1	empty chemical	.61	2.57	185	d
	Joshua	1000	2	N	18.3	6.7	1	1x1	coal	2.74	2.48	240	d

Clarks Ferry Site, Trip 2 (Concluded)

<i>Date</i>	<i>Name</i>	<i>Hp</i>	<i>Screws</i>	<i>Kort</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>No. of barges</i>	<i>Config</i>	<i>Type of barge</i>	<i>Draft (m)</i>	<i>Speed (m/s)</i>	<i>Dist. (m)</i>	<i>Direction</i>
10/19/91	Kathy Ellen	3800	2	N	46	10.7	15	3x5	closed hopper	2.74	1.92	195	d
	Jack Bullard	5600	2	Y	44.2	14.6	14	2x1+3x4	hopper	2.74	2.38	215	u
	Marc	1000	2	N	18.3	6.7	4	2x2	coal	2.74	2.7	205	d
	Conti-Nan (2)	4200	2	N	42.7	13.4	6	3x2	empty chemical	.61	2.84	185	u
	Cristina Ecstein	3200	2	N	35.4	10.5	8	3x2+2x1	empty	.61	2.88	215	u
	Coast Guard 65504	600	2	N	19.8	6.4	1	1x1	buoy tender/work barge	2.74	4.95	225	d
	Prairie Dawn	5000	2	Y	50	12.2	11	3x3+2	empty	.61	3.4	190	u
	Noname						2	2x1	chemical	2.74	2.63	230	d
	Coop. Ambassador	3800	2	Y	48.8	12.2	15	3x5	closed hopper	2.74	2.22	190	d
10/20/91	Yazoo City	4300	2	N	44.8	10.7	14	2+3x4	closed hopper		2.09	230	u
	George W. Banta	2400	2	N	30.2	9.1	3	1x3	petroleum	2.74	2.0	200	u

APPENDIX VIII.
RECREATIONAL TRAFFIC CHARACTERISTICS
AT ALL STUDY SITES

**McEver's Island Site
(NA)**

Kampsville Site, Trip 1

<i>Type</i>	<i>Date</i>	<i>Time</i>	<i>Approx. Speed</i>	<i>Approx. Distance (m)</i>	<i>Approx. Length (m)</i>	<i>Direction</i>
Houseboat	10/14/90	12:41	Medium	168	N/A	d/s

**Kampsville Site, Trip 2
(N/A)**

Apple River Island Site

<i>Type</i>	<i>Date</i>	<i>Time</i>	<i>Approx. Speed</i>	<i>Approx. Distance (m)</i>	<i>Approx. Length (m)</i>	<i>Direction</i>
Cabin Cruiser	5/21/90	12:09	N/A	244	9	u/s
Mississippi Belle II	5/22/90	9:57	N/A	229	45	d/s

Goose Island Site, Trip 1

<i>Type</i>	<i>Date</i>	<i>Time</i>	<i>Approx. Speed</i>	<i>Approx. Distance (m)</i>	<i>Approx. Length (m)</i>	<i>Direction</i>
Houseboat	8/25/90	12:23	High	350	N/A	u/s
Houseboat	8/25/90	13:05	N/A	350	N/A	u/s

Notes: N/A = not applicable
u/s = upstream
d/s = downstream

Goose Island Site, Trip 2

<i>Type</i>	<i>Date</i>	<i>Time</i>	<i>Approx. Speed</i>	<i>Approx. Distance (m)</i>	<i>Approx. Length (m)</i>	<i>Direction</i>
Houseboat	7/21/91	13:40	Medium	N/A	13.72	u/s
Houseboat	7/21/91	15:31	Slow	N/A	10.50	u/s

Clarks Ferry Site, Trip 1

<i>Type</i>	<i>Date</i>	<i>Time</i>	<i>Approx. Speed</i>	<i>Approx. Distance (m)</i>	<i>Approx. Length (m)</i>	<i>Direction</i>
Houseboat	5/18/91	15:14	N/A	N/A	12.19	d/s
Houseboat	5/19/91	12:44	N/A	250	N/A	d/s
Houseboat	5/19/91	14:17	N/A	270	N/A	u/s
Houseboat	5/19/91	15:40	N/A	220	N/A	d/s
Houseboat	5/19/91	17:17	Slow	250	N/A	u/s
Houseboat	5/20/91	14:13	N/A	250	N/A	u/s
Cruiser	5/21/91	10:22	Medium	300	N/A	u/s

Clarks Ferry Site, Trip 2

<i>Type</i>	<i>Date</i>	<i>Time</i>	<i>Approx. Speed</i>	<i>Approx. Distance (m)</i>	<i>Approx. Length (m)</i>	<i>Direction</i>
Cruiser	10/18/91	7:39	Medium	220	N/A	d/s
Houseboat	10/18/91	11:01	Slow-medium	280	N/A	d/s
Cruiser	10/19/91	14:47	Medium	220	N/A	d/s
Cruiser	10/19/91	17:15	Medium	N/A	N/A	u/s
Houseboat	10/20/91	9:38	Slow	150	N/A	d/s

Notes: N/A = not applicable
u/s = upstream
d/s = downstream

APPENDIX IX.
WIND SPEED AND DIRECTION AT ALL STUDY SITES

**McEver's Island Site
(NA)**

Kampsville Site, Trip 1

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
10/12/90	10:30	1.2	58
	11:00	0.9	66
10/13/90	10:00	2.5	152
	10:30	2.6	152
10/14/90	9:30	5.3	161
	10:00	5.9	164
	10:30	5.9	165
	11:00	3.3	164
	11:30	3.6	147
	12:00	5.3	160
	12:30	5.8	154
	13:00	5.1	147
	13:30	4.5	112
10/15/90	10:00	0.4	64
	10:30	0.9	86
	11:00	0.6	53
	11:30	1.1	88
	12:00	1.0	108
	12:30	2.0	115
	13:00	2.0	55
	13:30	1.4	53
	14:00	1.2	101
	14:30	1.6	105
	15:00	1.0	124
	15:30	1.1	228
	16:00	1.3	224
	16:30	2.8	155
	17:00	4.2	120

Kampsville Site, Trip 1 (Concluded)

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
10/16/90	9:00	3.7	169
	9:30	4.6	166
	10:00	4.7	169
	10:30	5.8	162
	11:00	6.3	162
	11:30	5.4	162
	12:00	6.7	160
	12:30	5.6	163
	13:00	5.3	161
	13:30	4.7	165
	14:00	3.5	165
	14:30	2.9	164
	15:00	3.9	165
	15:30	4.4	168
	16:00	3.4	173
	16:30	2.8	184
	17:00	1.3	241
	17:30	1.1	216
	18:00	1.8	204
10/17/90	10:00	8.8	166
	10:30	7.2	165
	11:00	7.2	165
	11:30	5.5	166
	12:00	6.2	169
	12:30	5.7	168
	13:00	5.3	166

Kampsville Site, Trip 2 (NA)

Apple River Island Site

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
5/19/90	17:30	4.1	196
5/20/90	10:30	0.5	52
	11:00	0.7	220
	11:30	0.8	219
	12:00	0.6	176
	12:30	1.3	116
	15:00	1.5	35
	15:30	0.6	42
	16:00	1.4	51
	16:30	0.2	49
	17:00	0.4	84
	17:30	0.2	62
5/21/90	10:30	1.0	173
	12:00	1.4	120
	12:30	1.6	39
	13:00	1.0	131
	13:30	1.3	103
	14:00	1.3	180
	14:30	0.5	125
	15:00	1.1	108
	15:30	0.4	93
	16:30	1.2	72
	17:30	0.5	149

Apple River Island Site (Concluded)

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
5/22/90	10:00	2.6	282
	10:30	2.4	289
	11:00	2.8	272
	11:30	1.9	262
	12:00	1.5	266
	12:30	1.6	252
	13:00	1.6	276
	13:30	2.2	258
	14:00	1.6	261
	14:30	1.2	188
	15:00	0.9	239
	15:30	2.4	272
	16:00	0.9	77
	16:30	1.2	184
	17:00	2.0	279
5/23/90	9:30	2.9	205
	10:00	4.1	254
	10:30	6.5	276
	11:00	5.3	273
	11:30	6.4	238
	12:00	5.3	235
	12:30	5.5	288
	13:00	4.7	311
	13:30	2.0	293
	14:00	4.5	279
	14:30	2.9	239
	15:00	4.2	278
	15:30	4.8	262
	16:00	4.1	285
	16:30	3.8	254
	17:00	4.9	245
	17:30	3.2	247
	18:00	2.8	226

Goose Island Site, Trip 1

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
8/24/90	10:30	4.3	121
	11:00	6.9	135
	11:30	6.8	134
	12:00	7.3	136
	12:30	7.9	127
	13:00	7.1	125
	13:30	6.4	135
	14:00	7.1	134
	14:30	7.6	127
	15:00	5.8	139
	15:30	6.5	117
	16:00	5.7	113
	16:30	6.7	125
	17:00	6.7	132
	17:30	6.7	122
8/25/90	10:30	0.4	137
	11:00	3.5	136
	11:30	4.6	128
	12:00	4.2	115
	12:30	6.4	130
	13:00	8.3	119
	13:30	7.6	139
	14:00	7.0	126
	14:30	8.4	131
	15:00	9.5	135
	15:30	7.2	105
	16:00	11.3	149
	16:30	10.7	134
	17:00	9.5	128
8/26/90	10:00	3.1	154
	10:30	3.3	139
	11:00	3.8	129
	11:30	3.1	139
	12:00	2.5	131
	12:30	3.4	136
	13:00	2.2	137
	13:30	3.0	122
	14:00	2.7	139

Goose Island Site, Trip 1 (Concluded)

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
8/27/90	14:30	3.6	128
	15:00	3.3	111
	15:30	3.3	131
	16:00	4.2	131
	16:30	5.1	127
	10:00	2.2	196
	10:30	2.8	124
	11:00	4.6	133
	11:30	4.2	125
	12:00	5.1	129
	12:30	4.9	123
	13:00	4.1	154
	13:30	4.8	183
	14:00	5.3	183
	14:30	3.7	206
	15:00	3.5	183
	15:30	4.1	265

Goose Island Site, Trip 2

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
7/18/91	10:00	2.1	180
	10:30	2.5	171
	11:00	2.5	183
	11:30	4.6	154
	12:00	2.6	176
	12:30	4.6	135
	13:00	5.9	133
	13:30	6.8	122
	14:00	3.9	177
	14:30	4.9	179
	15:00	3.6	191
	15:30	5.9	152
	16:00	6.4	136
	16:30	6.0	141

Goose Island Site, Trip 2 (Continued)

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
7/19/91	17:00	6.6	156
	17:30	7.8	151
	18:00	5.0	161
	10:30	8.4	142
	11:00	6.9	151
	11:30	7.5	159
	12:00	4.0	163
	12:30	10.4	141
	13:00	7.3	154
	13:30	4.0	167
	14:00	8.8	135
	14:30	7.7	160
	15:00	8.9	152
	15:30	7.7	146
	16:00	7.7	143
	16:30	8.4	144
	17:00	6.3	152
	17:30	8.2	139
	18:00	7.7	151
	18:30	5.6	171
	19:00	4.9	142
	19:30	5.5	128
7/22/91	9:30	5.1	251
	10:00	7.7	263
	10:30	8.2	281
	11:00	8.1	272
	11:30	9.0	89
	12:00	9.9	109
	12:30	7.8	263
	13:00	5.0	175
	13:30	5.3	265
	14:00	3.8	250
	14:30	2.9	249
	15:00	1.3	249
	15:30	1.3	192
	16:00	3.0	193
	16:30	3.6	163
	17:00	3.1	207

Goose Island Site, Trip 2 (Concluded)

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
7/23/91	17:30	2.1	166
	18:00	3.7	153
	9:30	10.2	240
	10:00	4.7	239
	10:30	4.1	218
	11:00	9.2	260
	11:30	5.7	231
	12:00	6.2	240
	12:30	7.9	253
	13:00	3.3	219
	13:30	5.4	244
	14:00	5.2	231
	14:30	6.2	192
	15:00	6.2	208
	15:30	6.5	193
	16:00	4.4	217
	16:30	6.6	202
	17:00	9.9	141
7/24/91	10:30	1.5	245
	11:00	1.6	251
	11:30	3.5	290
	12:00	2.3	126
	12:30	3.0	300
	13:00	3.0	252
	13:30	2.2	316
	14:00	2.4	283
	14:30	2.7	298
	15:00	8.8	292
	15:30	4.2	277
	16:00	1.9	213
	16:30	1.1	282
	17:00	1.4	274
	17:30	0.9	160

Clarks Ferry Site, Trip 1

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
5/17/91	11:00	4.5	101
	11:30	2.3	80
	12:00	2.5	83
	12:30	3.3	89
	13:00	2.2	82
	13:30	3.1	88
	14:00	2.6	76
	15:00	2.2	81
	15:30	2.4	79
	16:00	2.4	75
5/18/91	10:00	3.4	91
	10:30	3.5	39
	11:00	3.3	60
	11:30	2.9	71
	12:00	3.2	39
	12:30	4.9	39
	13:00	4.3	70
	13:30	4.0	171
5/19/91	9:00	4.9	113
	9:30	3.2	146
	10:00	2.7	185
	10:30	3.4	168
	11:00	3	170
	11:30	2.6	176
	12:00	2.7	185
	12:30	2.4	169
	13:00	2.8	106
	13:30	3.0	96
	14:00	3.3	91
	14:30	3.0	101
	15:00	2.9	86
	15:30	3.9	79
	16:00	2.6	84
	16:30	3.1	102
	17:00	2.5	76
	17:30	4.1	69

Clarks Ferry Site, Trip 1 (Concluded)

<i>Date</i>	<i>Time</i>	<i>Wind</i>	
		<i>Speed (mile/hr)</i>	<i>Direction</i>
5/20/91	9:30	1.9	116
	10:00	1.4	90
	10:30	1.4	100
	11:00	1.3	83
	11:30	1.5	89
	12:00	1.1	65
	12:30	1.2	88
	13:00	1.5	122
	13:30	1.6	84
	14:00	1.5	64
	14:30	1.5	61
	15:00	1.7	71
	15:30	1.7	79
	16:00	1.8	64
	16:30	1.5	78
	17:00	1.2	79
	17:30	1.1	78
	18:00	1.0	62
5/21/91	8:30	1.0	87
	9:30	1.0	77
	10:00	2.0	116
	10:30	5.2	143
	11:00	4.7	140
	11:30	5.0	127
	12:00	5.1	131
	12:30	2.7	132
	13:00	1.3	120
	13:30	3.8	163
	14:00	5.5	170
	14:30	2.9	167
	15:00	3.9	156
	15:30	4.9	150
	16:00	4.4	170
	16:30	4.6	169
	17:00	4.9	154
	17:30	2.2	180
	18:00	3.1	179

Wind Wave Event

Kampsville, Illinois River

Date: 10/17/90

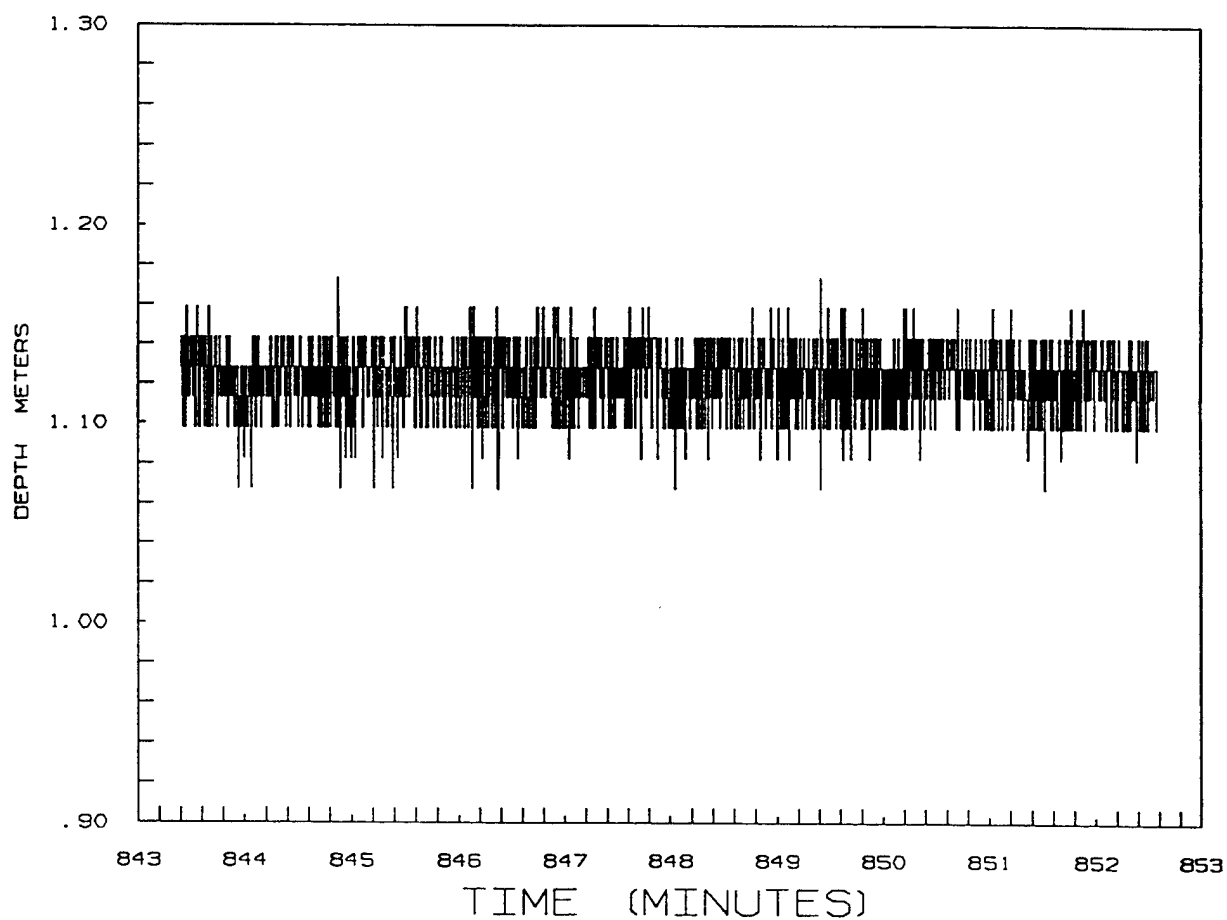
Max. wave height = 0.107 m

Significant wave height = 0.05 m

Sampling rate = 10

Starting time = 14: 12: 34

Mean wave height = 0.04 m



APPENDIX X.

**DATE AND TIME OF PASSAGE OF BARGE-TOWS AND MEAN AMBIENT
VELOCITY BEFORE BARGE-TOW PASSAGE FOR ALL STUDY SITES**

McEver's Island Site

Tow name	Date	Passing Time		Mean ambient velocity m/s							
		Beginning	Ending	MMB511/1998		MMB511/1999		MMB511/1000		MMB511/1001	
				U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}
R.W. Naye	5/16/89	14:23:30	14:26:32	0.070, 0.008		-	-	-	-	-	-
Evelyn C.		14:46:35	14:46:45	*		-	-	-	-	-	-
Mary Ellen	5/17/89	7:57:10	7:59:50	0.045, -0.003		-	-	-	-	-	-
Elaine Jones		8:07:00	8:09:22	*		-	-	-	-	-	-
Nicholas Duncan		15:29:38	15:33:40	0.320, 0.000		-	-	-	-	-	-
Mobil Leader	5/18/89	9:39:47	9:41:21	-		0.090, 0.000		0.060, -0.006		*	*
Reliance		12:16:45	12:19:13	-0.005, -0.018		0.115, -0.003		0.055, -0.008		*	*
Cooperative Vanguard		12:41:49	12:44:03	-0.019, -0.008		0.080, 0.002		0.040, -0.007		*	*
Marvin Norman		13:09:20	13:11:27	0.005, -0.002		0.100, 0.000		0.074, -0.008		*	*
Illini		14:31:36	14:33:34	-0.020, -0.015		0.092, 0.008		0.053, -0.003		*	*
Thurston B. Morton	5/19/89	10:37:56	10:40:40	-		0.099, 0.000		0.065, -0.005		*	*
Clarence G. Frame		10:45:36	10:47:40	-		0.098, 0.005		0.068, 0.000		*	*

- Meter was not available

* Meter did not work

McEver's Island Site (Concluded)

Tow name	Date	Passing Time		Mean ambient velocity m/s			
		Beginning	Ending	MMBS27/642		S4/071	
R.W. Naye Evelyn C.	5/16/89	14:23:30	14:26:32	U_{ma}	V_{ma}	U_{ma}	V_{ma}
		14:46:35	14:46:45	0.170, -0.005	*	0.070, -0.003	*
Mary Ellen Elaine Jones Nicholas Duncan	5/17/89	7:57:10	7:59:50	0.195, -0.050	*	0.053, -0.018	*
		8:07:00	8:09:22	*		*	
		15:29:38	15:33:40	0.140, 0.000		-	
Mobil Leader Reliance Cooperative Vanguard Marvin Norman Illini	5/18/89	9:39:47	9:41:21	-		0.030, 0.004	
		12:16:45	12:19:13	0.110, -0.003		0.010, -0.020	
		12:41:49	12:44:03	0.070, -0.004		0.018, -0.035	
		13:09:20	13:11:27	0.117, 0.003		0.080, 0.013	
		14:31:36	14:33:34	0.095, -0.006		-	
Thurston B. Morton Clarence G. Frame	5/19/89	10:37:56	10:40:40	-		*	
		10:45:36	10:47:40	-		0.093, -0.038	

- Meter was not available

* Meter did not work

Kampsville Site, Trip 1

Tow name	Date	Passing Time		Mean ambient velocity m/s											
		Beginning	Ending	MMB511/1001	MMB511/998	MMB511/999	MMB511/1000	MMB511/642							
Mr. Aldo	10/12/90	13:34:46	13:36:48	U _{ma} *	U _{ma} V _{ma}	U _{ma} V _{ma}	U _{ma} V _{ma}	U _{ma} V _{ma}							
Floyd Blaske		13:47:57	13:50:10	*	0.253,-0.005	0.318,-0.011	0.456,-0.008	0.445-0.017							
Marvin Norman	10/13/90	09:31:13	09:34:45	0.190,-0.007	0.333,-0.015	0.327,-0.020	*	0.435, 0.010							
Luke Burton		09:55:32	09:56:38	0.196,-0.005	0.334, 0.004	0.330,-0.016	0.466, 0.024	0.433, 0.017							
Sugarland		09:58:35	10:01:18	0.196,-0.006	0.334, 0.004	0.330,-0.016	0.466, 0.024	0.433, 0.017							
William C. Norman		11:08:41	11:10:15	0.204,-0.006	0.289, 0.007	0.341,-0.018	0.420,0.041	0.438, 0.014							
Frank H. Peavey		15:20:29	15:24:20	0.191,-0.006	0.295, 0.010	0.362, 0.003	0.397, 0.013	0.420, 0.015							
Conti Karla		16:23:56	16:27:38	0.204,-0.007	0.295, 0.011	0.356, 0.002	0.410, 0.018	0.424, 0.017							
Mr. Paul	10/14/90	10:17:12	10:18:58	0.211,-0.005	0.257, 0.024	0.397, 0.002	0.500, 0.040	0.443, -0.013							
Rambler		10:56:37	10:58:25	0.226,-0.002	0.290, 0.027	0.381, N/A	0.470, 0.030	0.438, 0.016							
Mr. Lawrence		11:42:09	11:44:22	0.216,-0.005	0.292, 0.025	0.385, 0.020	0.470, 0.032	0.445, 0.018							
Mallard		12:25:38	12:26:51	0.211,-0.002	0.290, 0.020	0.378, N/A	0.470, 0.032	0.441, -0.022							
Charles Lehman		13:28:18	13:31:24	0.215,-0.001	0.298, 0.032	0.397, 0.032	0.504, 0.038	0.446, 0.016							
Nicholas Duncan		15:29:11	15:31:36	0.230,-0.002	0.250, 0.026	0.395, 0.029	0.485, 0.035	0.467, 0.018							
Jeff Boat		15:57:43	16:00:46	0.235,-0.005	0.241, 0.025	0.380, 0.025	0.480, 0.035	0.461, 0.015							
Mary Ann		16:36:20	16:39:11	0.217, 0.000	0.245, 0.029	0.390, 0.032	0.515, 0.018	0.450, -0.020							
Ardyce Randall	10/15/90	09:49:07	09:51:32	0.235,-0.002	*	*	*	0.470, 0.011							
Mr. Paul		12:07:21	12:09:53	0.227,-0.006	0.351, 0.039	0.411, 0.032	*	0.459, 0.017							
Exxon St. Louis		14:51:40	14:53:18	0.240,-0.005	0.357, 0.034	0.411, 0.027	0.620, 0.000	0.477, 0.015							
Margaret O.		15:11:17	15:12:29	0.220,-0.005	0.350, 0.036	0.405, 0.030	0.422, 0.015	0.455, 0.020							
Mr. Lawrence		18:10:53	18:12:36	0.225,-0.005	0.374, 0.034	0.432, 0.028	0.390, 0.015	0.485, 0.017							
A.L. Smith	10/16/90	10:27:27	10:29:00	0.240,-0.002	0.375, 0.010	0.460,-0.007	0.780, 0.005	0.460, 0.016							
Ste. Genevieve		16:19:41	16:22:00	0.230,-0.005	0.378, 0.000	0.445,-0.022	0.720, 0.007	0.475, 0.018							
Nicole Brent	10/17/90	10:25:21	10:26:31	0.234, 0.000	0.410, 0.037	0.335, 0.030	*	0.470, 0.014							
Frank H. Peavey		11:14:06	11:15:20	0.240,-0.002	0.435, 0.028	0.330, 0.075	*	0.480, 0.013							

* Meter did not work

Kampsville Site, Trip 1 (Concluded)

Tow name	Date	Passing Time		Mean ambient velocity m/s					
		Beginning	Ending	MMB511/332		MMB527/040		MMB527/071	
				U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}
Mr. Aldo	10/12/90	13:34:46	13:36:48	0.520,-0.018		0.443,-0.020		0.468, 0.010	
Floyd Blaske		13:47:57	13:50:10	0.560,-0.020		0.460,-0.018		0.470,-0.002	
Marvin Norman	10/13/90	09:31:13	09:34:45	0.531, 0.005		*		0.445, 0.010	
Luke Burton		09:55:32	09:56:38	0.528,-0.005		*		0.440, 0.002	
Sugarland		09:58:35	10:01:18	0.528,-0.005		*		0.440, 0.005	
William C. Norman		11:08:41	11:10:15	0.546,-0.004		0.455,0.010		0.445, 0.004	
Frank H. Peavey		15:20:29	15:24:20	0.498, 0.005		0.430, 0.007		0.455,-0.001	
Conti Karla		16:23:56	16:27:38	0.505, 0.000		0.432, 0.010		0.480,-0.008	
Mr. Paul	10/14/90	10:17:12	10:18:58	0.525,-0.025		*		0.455, 0.006	
Rambler		10:56:37	10:58:25	0.540,-0.024		0.461, 0.031		*	
Mr. Lawrence		11:42:09	11:44:22	0.525,-0.019		0.444, 0.025		0.470,-0.002	
Mallard		12:25:38	12:26:51	0.520,-0.025		0.455, 0.021		0.478, 0.006	
Charles Lehman		13:28:18	13:31:24	0.535,-0.021		0.440, 0.026		0.460, 0.001	
Nicholas Duncan		15:29:11	15:31:36	0.560,-0.024		0.450, 0.021		0.477, 0.006	
Jeff Boat		15:57:43	16:00:46	0.550,-0.020		0.470, 0.019		0.480, 0.015	
Mary Ann		16:36:20	16:39:11	0.550, 0.028		0.490, 0.021		0.490, 0.008	
Ardyce Randall	10/15/90	09:49:07	09:51:32	0.541,-0.007		0.440, 0.021		0.465, 0.004	
Mr. Paul		12:07:21	12:09:53	0.535,-0.006		0.440, 0.020		0.470,-0.010	
Exxon St. Louis		14:51:40	14:53:18	0.558,-0.005		0.450, 0.020		*	
Margaret O.		15:11:17	15:12:29	0.550, 0.000		0.480, 0.021		0.485, 0.000	
Mr. Lawrence		18:10:53	18:12:36	0.540,-0.012		*		*	
A.L. Smith	10/16/90	10:27:27	10:29:00	0.530, -0.005		0.452, 0.020		0.490, 0.004	
Ste. Genevieve		16:19:41	16:22:00	0.525,-0.014		0.449, 0.029		0.470, 0.000	
Nicole Brent	10/17/90	10:25:21	10:26:31	0.510,-0.025		0.465, 0.015		0.450, 0.005	
Frank H. Peavey		11:14:06	11:15:20	0.515,-0.020		0.475, 0.005		0.460, 0.009	

* Meter did not work

Kampsville Site, Trip 2

Tow name	Date	Passing Time		Mean ambient velocity m/s					
		Beginning	Ending	MMB511/1001		MMB511/998		MMB511/999	
Ranger	8/13/91	10:08:48	10:10:32	U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}
Dixie Patriot		10:48:40	10:50:01	*	*	0.151, 0.018		0.139, 0.002	
Orleanian		16:39:53	16:42:40	0.073, 0.006		*		0.148, 0.006	
Pat Breen		17:45:36	17:47:58	0.052, 0.005		*		0.155, 0.000	
Dixie Express		18:15:23	18:16:04	0.091, 0.000		*		0.116, 0.002	
Night-14-01	8/14/91	04:21:06	04:23:57	0.122, -0.001		*		0.139, 0.001	
Night-14-02		07:15:57	07:16:51	0.106, 0.001		*		0.128, 0.005	
Irving Crown		10:08:34	10:10:45	0.073, 0.006		0.070, N/A		0.147, 0.004	
George W. Shamblin		13:16:16	13:16:56	0.096, 0.001		*		0.212, 0.009	
Katherine L.		13:26:36	13:27:20	0.092, 0.001		0.311, -0.002		0.123, -0.011	
Thruston B. Morton		14:21:58	14:23:57	0.063, 0.004		*		0.151, -0.016	
Julie White		14:32:12	14:35:45	0.031, 0.002		*		0.121, -0.016	
Ranger		17:07:52	17:08:16	0.071, 0.006		*		0.119, -0.024	
Illini		19:12:43	19:14:43	0.051, 0.007		*		0.125, -0.016	
Bronwynne Brent		19:23:50	19:25:19	0.046, 0.007		*		0.092, -0.015	
Bill McCormick	8/15/91	00:02:15	00:04:28	0.109, 0.005		*		0.083, -0.011	
Marvin E. Norman		03:27:22	03:29:18	0.108, 0.002		*		*	
Olmstead		13:02:42	13:05:16	0.067, 0.003		0.072, -0.028		*	
Jack D. Wofford		13:39:18	13:41:57	0.064, 0.010		0.073, -0.025		0.129, -0.010	
Dixie Express		15:09:12	15:10:08	0.067, 0.011		0.056, -0.021		0.121, -0.019	
Hal D. Miller		17:45:56	17:46:56	0.072, 0.009		0.071, -0.024		0.110, -0.015	
Jesse Brent		18:10:31	18:10:55	0.071, 0.010		0.074, -0.027		0.118, -0.012	

* Meter did not work

Kampsville Site, Trip 2 (Concluded)

Tow name	Date	Passing Time		Mean ambient velocity m/s					
		Beginning	Ending	MMB511/1000	MMB527/642	MMB527/332	U _{ma}	V _{ma}	U _{ma}
Ranger	8/13/91	10:08:48	10:10:32	U _{ma} *	U _{ma} V _{ma}	U _{ma} V _{ma}	0.391, 0.000	0.020, N/A	0.166, 0.012
Dixie Patriot		10:48:40	10:50:01				0.029, -0.003		0.170, 0.010
Orleanian		16:39:53	16:42:40	*			0.140, -0.004		0.159, 0.006
Pat Breen		17:45:36	17:47:58	*			0.119, -0.001		0.151, 0.018
Dixie Express		18:15:23	18:16:04	*			0.138, -0.006		0.174, 0.012
Night-14-01	8/14/91	04:21:06	04:23:57	*			0.132, -0.010		0.175, 0.008
Night-14-02		07:15:57	07:16:51	*			0.138, -0.010		0.162, 0.004
Irving Crown		10:08:34	10:10:45	*			0.129, -0.015		0.142, -0.016
George W. Shamblyn		13:16:16	13:16:56	*			*		0.136, 0.010
Katherine L.		13:26:36	13:27:20	0.319, 0.018			*		0.149, 0.008
Thruston B. Morton		14:21:58	14:23:57	*			*		0.156, 0.013
Julie White		14:32:12	14:35:45	*			*		0.160, 0.026
Ranger		17:07:52	17:08:16	*			*		0.160, 0.009
Illini		19:12:43	19:14:43	*			*		0.127, 0.012
Bronwynne Brent		19:23:50	19:25:19	*			*		0.118, 0.010
Bill McCormick	8/15/91	00:02:15	00:04:28	*			*		0.150, 0.008
Marvin E. Norman		03:27:22	03:29:18	*			*		0.170, 0.006
Olmstead		13:02:42	13:05:16	0.023, 0.004			*		0.180, 0.012
Jack D. Wofford		13:39:18	13:41:57	*			*		0.141, 0.013
Dixie Express		15:09:12	15:10:08	*			0.095, 0.000		0.159, 0.010
Hal D. Miller		17:45:56	17:46:56	*			0.142, -0.006		0.142, 0.006
Jesse Brent		18:10:31	18:10:55	*			0.123, -0.004		0.141, 0.008

* Meter did not work

Apple River Island Site

Tow name	Date	Passing Time		Mean ambient velocity m/s											
		Beginning	Ending	MMB511/1001	MMB511/1000	MMB511/998	MMB527/642	MMB527/332							
Yazoo Cooperative Ambassador Christine Bailey Kathy Ellen	5/18/90	16:20:16	16:23:41	U _{ma} 0.228, -0.009	U _{ma} 0.253, -0.021	U _{ma} 0.358, -0.024	U _{ma} 0.297, -0.001	U _{ma} 0.118, -0.001							
		16:46:42	16:48:55	0.212, -0.005	0.252, -0.025	*	0.288, -0.003	0.143, 0.001							
		17:21:24	17:23:17	0.227, -0.008	0.241, -0.018	*	0.265, -0.001	0.129, 0.000							
		20:07:30	20:09:39	0.219, -0.004	0.241, -0.018	*	0.256, 0.001	0.117, -0.002							
W.A. Kernan Hornet Conti-Bonnie Becky Lynn	5/19/90	10:04:10	10:07:04	0.221, -0.006	0.228, -0.023	0.317, 0.013	0.158, -0.009	-0.005, -0.009							
		11:20:37	11:21:31	0.221, 0.001	0.229, -0.021	0.351, -0.016	0.151, -0.001	0.091, -0.010							
		11:40:41	11:42:25	0.229, 0.001	0.245, -0.021	0.371, -0.004	0.149, -0.009	0.101, -0.010							
		11:56:12	11:58:03	0.211, -0.001	0.229, -0.022	0.382, 0.011	0.152, -0.010	0.110, -0.009							
Merlin Banta Rusty Flowers Tom Talbert Herman Pott	5/20/90	09:09:21	09:10:12	0.211, 0.001	0.241, -0.015	*	0.132, 0.013	0.053, -0.007							
		11:27:57	11:29:38	0.209, -0.001	0.241, -0.006	0.383, -0.050	0.110, 0.012	*							
		12:36:12	12:37:48	0.219, -0.001	0.228, -0.019	0.377, -0.039	0.091, 0.027	*							
		15:33:19	15:35:31	0.222, -0.003	0.221, -0.016	0.389, -0.024	0.072, 0.022	*							
Walter Brunson Dell Butcher Mary Gail T.S. Kunsman D. Ray Miller	5/21/90	10:06:14	10:08:09	0.226, 0.000	0.261, -0.014	*	0.493, 0.005	0.378, -0.025							
		11:00:40	11:02:30	0.220, 0.001	0.251, -0.015	0.353, -0.018	0.521, 0.015	0.380, -0.020							
		14:19:17	14:20:01	0.248, -0.009	0.228, -0.018	0.455, -0.010	0.488, 0.001	0.357, 0.001							
		14:37:15	14:38:33	0.247, -0.001	0.239, -0.014	0.453, 0.007	0.490, 0.003	0.378, -0.001							
Mary Gail Trojan Melinda Brent Corporate Mariner Ed Renshaw	5/22/90	14:55:21	14:57:23	0.242, -0.009	0.250, -0.014	0.469, 0.041	0.482, 0.001	0.391, -0.011							
		10:09:50	10:10:25	0.238, -0.010	0.258, -0.012	*	0.520, -0.017	0.358, -0.016							
		17:08:42	17:09:52	0.249, -0.003	0.242, -0.014	0.500, -0.031	0.554, -0.024	0.354, -0.006							
		17:28:40	17:29:27	0.240, -0.001	0.249, -0.012	0.502, -0.031	0.498, -0.026	0.351, -0.002							
Kevin Michael Jack D. Wofford Trojan	5/23/90	18:06:22	18:07:30	0.239, -0.001	0.246, -0.010	*	0.518, -0.020	0.353, -0.016							
		06:52:42	06:55:13	-	-	-	-	-							
		16:13:23	16:14:20	0.241, -0.001	0.228, -0.011	0.502, 0.012	0.506, -0.001	0.312, -0.001							
		16:23:20	16:24:42	0.238, -0.001	0.231, -0.010	0.503, 0.012	0.529, -0.001	0.309, 0.009							

- Meter was not available
* Meter did not work

Apple River Island Site (Concluded)

Tow name	Date	Passing Time		Mean ambient velocity m/s					
		Beginning	Ending	MMB511/999		S4/071		S4/040	
				U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}
Yazoo	5/18/90	16:20:16	16:23:41	*					
Cooperative Ambassador		16:46:42	16:48:55	*					
Christine Bailey		17:21:24	17:23:17	*					
Kathy Ellen		20:07:30	20:09:39	*					
W.A. Kernan	5/19/90	10:04:10	10:07:04	*		0.624, -0.048			
Hornet		11:20:37	11:21:31	*		0.647, -0.049			
Conti-Bonnie		11:40:41	11:42:25	*		0.640, -0.055			
Becky Lynn		11:56:12	11:58:03	*		0.648, -0.061			
Merlin Banta	5/20/90	09:09:21	09:10:12	*				0.561, 0.004	
Rusty Flowers		11:27:57	11:29:38	*				*	
Tom Talbert		12:36:12	12:37:48	*				0.627, 0.014	
Herman Pott		15:33:19	15:35:31	*		0.670, -0.051		*	
Walter Brunson	5/21/90	10:06:14	10:08:09	*		0.597, -0.087		*	
Dell Butcher		11:00:40	11:02:30	*		0.578, -0.091		*	
Mary Gail		14:19:17	14:20:01	*				0.520, -0.082	
T.S. Kunsman		14:37:15	14:38:33	*		0.559, -0.070		0.588, -0.090	
D. Ray Miller		14:55:21	14:57:23	*		0.567, -0.079		0.591, -0.093	
Mary Gail	5/22/90	10:09:50	10:10:25	*		0.583, -0.102		0.579, -0.090	
Trojan		17:08:42	17:09:52	*		0.568, -0.104		0.558, -0.091	
Melinda Brent		17:28:40	17:29:27	*		0.588, -0.109		*	
Corporate Mariner		18:06:22	18:07:30	*		0.561, -0.101		*	
Ed Renshaw		19:49:48	19:49:48	*		*		0.570, -0.090	
Kevin Michael	5/23/90	06:52:42	06:55:13	*				0.592, -0.090	
Jack D. Wofford		16:13:23	16:14:20	*				0.609, -0.081	
Trojan		16:23:20	16:24:42	*					

- Meter was not available

* Meter did not work

Goose Island Site, Trip 1

Tow name	Date	Passing Time		Mean ambient velocity m/s											
				MMB511/1001			MMB511/998			MMB511/999			MMB511/1000		
		Beginning	Ending	U _{ma}	V _{ma}		U _{ma}	V _{ma}		U _{ma}	V _{ma}		U _{ma}	V _{ma}	
Sierra Dawn	8/24/90	10:51:08	10:52:54	0.428, -0.008	0.409, -0.004		0.409, -0.004	0.443, -0.003		0.443, -0.003	0.294, 0.003		0.294, 0.003	0.350, -0.018	
Dell Butcher		13:42:01	13:43:52	0.409, -0.011	0.391, 0.020		0.391, 0.020	0.429, -0.014		0.429, -0.014	0.281, 0.001		0.281, 0.001	0.366, -0.019	
William C. Norman		13:54:34	13:57:35	0.294, -0.006	0.397, 0.020		0.397, 0.020	0.428, -0.019		0.428, -0.019	0.295, 0.001		0.295, 0.001	0.353, -0.011	
Normania		14:16:33	14:20:50	0.408, 0.012	0.381, 0.019		0.381, 0.019	0.419, -0.019		0.419, -0.019	0.285, 0.001		0.285, 0.001	0.353, -0.015	
Dare Carlton		16:39:17	16:40:57	0.417, 0.003	0.377, 0.019		0.377, 0.019	0.406, -0.025		0.406, -0.025	0.259, 0.006		0.259, 0.006	*	
Hugh C. Blaske	8/25/90	11:19:46	11:22:52	0.394, 0.030	0.371, 0.020		0.371, 0.020	0.459, -0.016		0.459, -0.016	0.287, -0.001		0.287, -0.001	0.493, -0.001	
Teresa Renee B.		12:15:45	12:17:17	0.358, 0.020	0.373, 0.020		0.373, 0.020	0.467, -0.014		0.467, -0.014	0.296, 0.001		0.296, 0.001	0.492, 0.001	
Trojan Warrior		12:24:48	12:26:28	0.349, 0.020	0.364, 0.020		0.364, 0.020	0.457, -0.015		0.457, -0.015	0.291, 0.001		0.291, 0.001	0.491, 0.002	
Hoosier State		15:45:01	15:47:01	0.324, 0.012	0.352, 0.020		0.352, 0.020	0.408, -0.022		0.408, -0.022	0.279, -0.001		0.279, -0.001	0.458, 0.001	
Kevin Michael	8/26/90	11:46:36	11:48:36	-	0.373, 0.020		0.373, 0.020	0.448, 0.020		0.448, 0.020	0.270, 0.009		0.270, 0.009	-	
Sumac		13:27:02	13:27:21	-	0.341, -0.007		0.341, -0.007	0.447, 0.030		0.447, 0.030	0.266, 0.011		0.266, 0.011	-	
Twin City		14:21:22	14:24:00	-	0.346, 0.020		0.346, 0.020	0.443, 0.012		0.443, 0.012	0.258, 0.015		0.258, 0.015	-	
Cooperative Vanguard		14:58:35	15:01:11	-	0.358, 0.020		0.358, 0.020	0.451, 0.011		0.451, 0.011	0.260, 0.012		0.260, 0.012	-	
Superior	8/27/90	09:54:38	09:58:22	-	0.457, -0.020		0.457, -0.020	0.547, 0.025		0.547, 0.025	*		*	-	
Helen M. Clements		12:36:11	12:38:32	-	0.428, 0.030		0.428, 0.030	0.512, 0.013		0.512, 0.013	0.358, 0.020		0.358, 0.020	-	

- Meter was not available

* Meter did not work

Goose Island Site, Trip 1 (Concluded)

Tow name	Date	Passing Time		Mean ambient velocity m/s					
		Beginning	Ending	MMB527/B332		S4/071		S4/040	
Sierra Dawn	8/24/90	10:51:08	10:52:54	U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}
Dell Butcher		13:42:01	13:43:52	0.393, -0.001	0.504, -0.012	0.478, 0.084			
William C. Norman		13:54:34	13:57:35	0.389, 0.002	0.378, -0.034	0.472, 0.870			
Normania		14:16:33	14:20:50	0.381, 0.027	0.358, -0.037	0.462, 0.094			
Dare Carlton		16:39:17	16:40:57	0.319, -0.009	*	0.481, 0.097			
				0.223, 0.032	0.458, 0.013	-			
Hugh C. Blaske	8/25/90	11:19:46	11:22:52	0.152, -0.001	0.383, -0.012	0.469, 0.072			
Teresa Renee B.		12:15:45	12:17:17	0.117, -0.002	*	0.432, 0.051			
Trojan Warrior		12:24:48	12:26:28	0.109, -0.010	0.422, -0.070	0.416, 0.048			
Hoosier State		15:45:01	15:47:01	0.242, 0.011	0.327, 0.002	0.482, 0.062			
Kevin Michael	8/26/90	11:46:36	11:48:36	-	*	0.451, 0.129			
Sumac		13:27:02	13:27:21	-	*	0.465, 0.041			
Twin City		14:21:22	14:24:00	-	-	0.455, 0.038			
Cooperative Vanguard		14:58:35	15:01:11	-	-	0.432, 0.052			
Superior	8/27/90	09:54:38	09:58:22	-	-	-			
Helen M. Clements		12:36:11	12:38:32	-	-	-			

- Meter was not available

* Meter did not work

Goose Island Site, Trip 2

Tow name	Date	Passing Time		Mean ambient velocity m/s											
				MMBS11/1001	MMBS11/1130	MMBS11/1131	MMBS11/1998	MMBS11/1999							
		Beginning	Ending	U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}
Ardyce Randall	7/18/91	10:42:18	10:44:10	0.054, -0.009	0.091, -0.001	0.062, 0.001	0.024, 0.010	0.038, -0.016							
Scarlet Knight		12:26:59	12:28:46	0.306, 0.009	0.232, 0.014	0.261, 0.003	-0.017, 0.010	0.048, -0.020							
James F. Neal		14:17:04	14:18:34	0.301, 0.010	0.158, 0.006	0.267, 0.002	-0.001, 0.009	0.036, -0.018							
Helen M. Clements		17:23:03	17:25:22	0.288, 0.010	0.166, 0.010	0.259, 0.010	0.010, 0.007	0.036, -0.020							
Elizabeth Ann		18:00:59	18:02:46	-	-	-	-	-							
Frank T. Heffelfinger	7/19/91	11:03:32	11:05:24	0.298, 0.011	0.142, 0.014	0.218, 0.006	0.029, 0.011	0.005, -0.003							
Queen City		14:33:45	14:35:21	0.259, 0.010	0.132, 0.011	0.197, 0.002	0.018, 0.011	*							
Helen M. Clements		16:24:27	16:26:12	0.251, 0.009	0.121, 0.014	0.185, 0.001	*	0.012, 0.001							
Frank T. Heffelfinger		16:33:21	16:36:52	0.252, 0.009	0.124, 0.014	0.183, 0.001	*	0.006, -0.001							
Cooperative Venture		18:05:37	18:08:27	0.272, -0.010	0.138, 0.003	0.195, 0.004	*	*							
Volunteer State		18:55:16	18:56:45	0.262, 0.010	0.140, 0.007	0.192, 0.001	-	-							
Prairie Dawn	7/20/91	8:09:31	8:11:39	-	-	-	-	-0.001, -0.006							
Prosperity		8:19:27	8:22:28	-	-	-	-	0.011, 0.006							
Clyde Butcher		11:39:19	11:40:55	-	-	-	-	-							
Lil Charley		11:55:54	11:56:27	-	-	-	-	-							
C.W. Rushing		13:31:19	13:31:38	*	0.142, 0.009	0.214, 0.003	-	0.011, 0.001							
Conti-Nan		16:56:41	16:59:16	0.261, 0.011	0.218, 0.013	0.206, 0.010	*	*							
Cooperative Vanguard	7/21/91	13:08:36	13:11:50	0.280, 0.006	0.202, -0.001	0.241, 0.002	0.009, 0.009	0.009, -0.006							
Conti-Karla		14:57:38	14:59:13	0.259, 0.004	0.206, 0.005	0.239, 0.009	-0.011, -0.002	0.047, -0.011							
Cooperative Mariner	7/22/91	10:34:47	10:36:47	0.254, 0.015	0.129, 0.011	0.240, 0.004	0.041, -0.004	0.071, -0.008							
Hornet		12:11:57	12:13:47	0.249, 0.016	0.189, 0.011	0.230, 0.006	0.024, -0.006	0.056, -0.010							
Cooperative Ambassador		13:16:41	13:18:43	0.248, 0.012	0.201, 0.003	0.229, 0.003	0.012, -0.004	0.080, 0.010							
Eastern		13:20:30	13:23:42	0.251, 0.011	0.198, 0.003	0.230, -0.001	0.011, -0.003	0.079, 0.011							
Sam M. Fleming		13:24:11	13:25:52	0.254, 0.011	0.197, 0.003	0.238, 0.001	0.028, -0.003	0.088, 0.010							
Kevin Michael		14:00:12	14:02:12	0.241, 0.011	0.206, 0.004	0.232, 0.004	*	*							
A.M. Thompson	7/23/91	14:12:24	14:14:23	0.265, 0.014	0.209, 0.003	0.239, 0.006	*	0.084, 0.014							
Lil Charley		14:20:30	14:20:55	0.249, 0.016	0.193, 0.004	0.221, 0.006	*	0.088, 0.021							
Badger		15:55:55	15:57:30	0.266, 0.016	0.190, 0.001	0.244, 0.007	*	0.075, 0.015							
Kay D		15:59:29	16:00:13	0.263, 0.015	0.197, 0.001	0.245, 0.009	*	0.092, 0.021							

Goose Island Site, Trip 2 (Continued)

Tow name	Date	Passing Time		Mean ambient velocity m/s									
		Beginning	Ending	MMBS11/1001		MMBS11/1130		MMBS11/1131		MMBS11/998		MMBS11/999	
Evey-T		16:24:21	16:26:55	U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}	U_{ma}	V_{ma}
				0.260, 0.016		0.185, 0.001		0.232, 0.003		*		*	
G.R. Packet	7/24/91	8:25:25	8:28:39	0.432, -0.209		0.235, -0.009		0.209, 0.007		-0.005, 0.006		0.073, 0.024	
Mary L.		9:14:50	9:17:21	0.423, -0.209		0.237, -0.019		0.210, 0.002		0.048, -0.006		0.147, 0.033	
Dud Hollinger		9:58:51	10:02:05	0.412, -0.200		0.240, -0.016		0.209, 0.006		0.036, 0.001		0.135, 0.034	
C.W. Rushing		12:13:19	12:13:57	0.409, -0.201		0.230, -0.016		0.219, 0.008		0.021, 0.005		0.084, 0.021	
Dell Butcher		13:44:39	13:46:27	0.426, -0.206		0.227, -0.009		0.206, 0.001		0.008, 0.000		0.071, 0.026	
Coral Dawn		14:48:44	14:51:19	0.411, -0.203		0.227, -0.015		0.199, 0.002		0.003, 0.006		0.062, 0.021	
Teresa R. Beesecker		15:43:33	15:45:33	0.411, -0.205		0.245, -0.019		0.215, 0.006		0.036, 0.001		0.107, 0.037	

Goose Island Site, Trip 2 (Continued)

Tow name	Date	Passing Time		Induced velocity m/s											
		Beginning	Ending	MMB511/1000		MMB527/642		MMB527/332		S4/071		S4/151			
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}		
Ardyce Randall Scarlet Knight James F. Neal Helen M. Clements Elizabeth Ann	7/18/91	10:42:18	10:44:10	0.031, -0.009		0.443, 0.001		0.527, -0.001		-		-0.086, -0.006			
		12:26:59	12:28:46	0.051, -0.019		0.482, 0.001		0.481, 0.002		-		-			
		14:17:04	14:18:34	0.029, -0.019		0.489, 0.001		0.497, -0.001		0.611, 0.043		0.649, 0.111			
		17:23:03	17:25:22	0.035, -0.018		0.489, 0.003		0.482, -0.011		-		*			
		18:00:59	18:02:46	-		0.525, -0.001		*		-		-			
Frank T. Heffelfinger Queen City Helen M. Clements Frank T. Heffelfinger Cooperative Venture Volunteer State	7/19/91	11:03:32	11:05:24	0.011, 0.000		0.450, -0.001		0.631, -0.011		-		-			
		14:33:45	14:35:21	0.140, -0.010		0.428, -0.011		0.581, -0.011		*		-			
		16:24:27	16:26:12	0.027, -0.006		0.432, -0.014		0.589, -0.009		0.556, 0.016		-			
		16:33:21	16:36:52	0.019, 0.001		0.418, -0.010		0.583, -0.004		0.542, 0.018		-			
		18:05:37	18:08:27	0.017, 0.010		-		-		-		-			
		18:55:16	18:56:45	-		-		-		-		-			
Prairie Dawn Prosperity Clyde Butcher Lil Charley C. W. Rushing Conti-Nan	7/20/91	8:09:31	8:11:39	0.032, 0.011		-		-		-		0.620, 0.121			
		8:19:27	8:22:28	0.028, 0.011		0.436, -0.022		0.559, -0.016		-		0.603, 0.122			
		11:39:19	11:40:55	-		0.391, -0.016		0.547, -0.024		-		0.676, 0.131			
		11:55:54	11:56:27	-		0.398, -0.010		0.533, -0.021		-		0.646, 0.119			
		13:31:19	13:31:38	0.049, -0.006		0.411, -0.022		0.543, -0.010		-		0.621, 0.119			
		16:56:41	16:59:16	0.019, 0.000		0.423, -0.015		0.479, -0.030		-		0.598, 0.119			
Cooperative Vanguard Conti-Karla	7/21/91	13:08:36	13:11:50	0.011, -0.001		0.451, -0.015		0.499, -0.010		0.497, 0.021		0.611, 0.111			
		14:57:38	14:59:13	*		0.411, -0.014		0.478, -0.015		0.482, 0.025		0.562, 0.091			

Goose Island Site, Trip 2 (Continued)

Tow name	Date	Passing Time		Induced velocity m/s											
		Beginning	Ending	MMB511/1000		MMB527/642		MMB527/332		S4/071		S4/151			
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}		
Cooperative Mariner Hornet Cooperative Ambassador Eastern	7/22/91	10:34:47	10:36:47	0.093, -0.015		0.421, -0.011		0.382, -0.031		-		0.591, 0.109			
		12:11:57	12:13:47	0.079, -0.011		0.411, -0.011		0.497, -0.009		0.473, 0.031		0.582, 0.110			
		13:16:41	13:18:43	0.061, -0.009		0.361, -0.001		0.462, -0.012		0.477, 0.030		0.568, 0.101			
		13:20:30	13:23:42	0.062, -0.011		0.360, -0.001		0.455, -0.011		0.476, 0.033		0.546, 0.102			
		13:24:11	13:25:52	0.082, -0.013		0.379, -0.008		0.449, -0.011		0.491, 0.025		0.549, 0.111			
Sam M. Fleming Kevin Michael		14:00:12	14:02:12	*		0.413, -0.010		0.447, -0.021		0.461, 0.026		0.581, 0.110			
A.M. Thompson Lil Charley Badger Kay D Evey-T	7/23/91	14:12:24	14:14:23	0.067, -0.010		0.421, -0.019		0.468, -0.024		0.512, 0.065		0.555, 0.099			
		14:20:30	14:20:55	0.077, -0.003		0.403, -0.018		0.447, -0.021		0.518, 0.063		0.561, 0.102			
		15:55:55	15:57:30	0.060, -0.010		0.437, -0.011		0.484, -0.020		0.548, -0.060		0.572, 0.102			
		15:59:29	16:00:13	0.070, -0.013		0.448, 0.015		0.467, -0.021		0.522, 0.061		0.571, 0.117			
		16:24:21	16:26:55	*		0.445, -0.016		0.492, -0.019		0.531, 0.055		0.579, 0.106			
G.R. Packet Mary L. Dud Hollinger C.W. Rushing Dell Butcher	7/24/91	8:25:25	8:28:39	0.060, -0.001		0.331, 0.011		0.142, 0.009		-		0.547, 0.095			
		9:14:50	9:17:21	0.131, -0.021		0.325, 0.011		0.141, 0.011		-		0.566, 0.100			
		9:58:51	10:02:05	0.112, -0.010		*		0.141, 0.010		0.498, 0.053		0.557, 0.083			
		12:13:19	12:13:57	0.091, -0.006		0.309, 0.011		0.142, 0.001		0.468, 0.051		0.534, 0.086			
		13:44:39	13:46:27	0.051, 0.001		0.301, 0.011		0.157, -0.001		0.477, 0.055		0.498, 0.079			
Coral Dawn Teresa R. Beesecker		14:48:44	14:51:19	*		0.297, 0.009		0.157, 0.000		0.483, 0.060		0.530, 0.092			
		15:43:33	15:45:33	0.116, 0.000		0.311, 0.011		0.162, -0.001		0.490, 0.069		0.540, 0.067			

Goose Island Site, Trip 2 (Continued)

Tow name	Date	Passing Time		Induced velocity m/s					
		Beginning	Ending	S4/040		S4/832		S4/834	
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
Ardyce Randall Scarlet Knight James F. Neal Helen M. Clements Elizabeth Ann	7/18/91	10:42:18	10:44:10	-	-	0.072, 0.074	-	0.741, 0.019	-
		12:26:59	12:28:46	-	-	0.031, 0.048	-	0.717, 0.001	-
		14:17:04	14:18:34	0.623, 0.070	-	-	-	0.437, 0.617	-
		17:23:03	17:25:22	0.678, 0.142	-	-	-	0.404, 0.572	-
		18:00:59	18:02:46	-	-	-	-	-	-
Frank T. Heffelfinger Queen City Helen M. Clements Frank T. Heffelfinger Cooperative Venture Volunteer State	7/19/91	11:03:32	11:05:24	-	-	-	-	0.691, 0.029	-
		14:33:45	14:35:21	-	-	-	-	0.686, 0.021	-
		16:24:27	16:26:12	-	-	-	-	0.687, 0.011	-
		16:33:21	16:36:52	-	-	-	-	0.693, 0.015	-
		18:05:37	18:08:27	-	-	-	-	0.693, 0.019	-
		18:55:16	18:56:45	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
Prairie Dawn Prosperity Clyde Butcher Lil Charley C.W. Rushing Conti-Nan	7/20/91	8:09:31	8:11:39	-	-	-	-	0.657, 0.020	-
		8:19:27	8:22:28	-	-	-	-	0.671, 0.028	-
		11:39:19	11:40:55	-	-	0.659, 0.030	-	0.681, 0.021	-
		11:55:54	11:56:27	-	-	0.673, 0.022	-	0.698, 0.012	-
		13:31:19	13:31:38	-	-	0.670, 0.020	-	0.672, 0.010	-
		16:56:41	16:59:16	-	-	0.680, 0.010	-	0.679, 0.018	-
Cooperative Vanguard Conti-Karla	7/21/91	13:08:36	13:11:50	0.619, 0.180	-	0.609, 0.010	-	0.647, 0.027	-
		14:57:38	14:59:13	0.590, 0.151	-	0.643, 0.010	-	0.647, 0.014	-

Goose Island Site, Trip 2 (Concluded)

Tow name	Date	Passing Time		Induced velocity m/s			
		Beginning	Ending	S4/040		S4/832	
				U_{im}	V_{im}	U_{im}	V_{im}
Cooperative Mariner Hornet Cooperative Ambassador Eastern Sam M. Fleming Kevin Michael	7/22/91	10:34:47	10:36:47	0.581, 0.152		0.598, -0.001	0.617, 0.019
		12:11:57	12:13:47	0.597, 0.160		0.618, 0.010	0.626, 0.019
		13:16:41	13:18:43	0.550, 0.131		0.595, 0.012	0.599, 0.022
		13:20:30	13:23:42	0.550, 0.139		0.604, 0.003	0.590, 0.021
		13:24:11	13:25:52	0.584, 0.151		0.640, 0.009	0.616, 0.029
A.M. Thompson Lil Charley Badger Kay D Evey-T	7/23/91	14:00:12	14:02:12	0.569, 0.126		0.632, -0.010	0.611, 0.019
		14:12:24	14:14:23	0.653, 0.090		0.648, 0.042	0.582, 0.033
		14:20:30	14:20:55	0.588, 0.072		0.628, 0.039	0.592, 0.031
		15:55:55	15:57:30	0.641, 0.100		0.622, 0.050	0.626, 0.030
		15:59:29	16:00:13	0.611, 0.102		0.600, 0.047	0.631, 0.029
G.R. Packet Mary L. Dud Hollinger	7/24/91	16:24:21	16:26:55	0.609, 0.102		0.631, 0.042	0.641, 0.026
		8:25:25	8:28:39	0.590, 0.095		0.600, 0.039	0.591, 0.032
		9:14:50	9:17:21	0.561, 0.100		0.582, 0.039	-

Clarks Ferry Site, Trip 1

Tow name	Date	Passing Time		Mean ambient velocity m/s							
		Beginning	Ending	MMBS11/1001	MMBS11/1130	MMBS11/1131	MMBS11/1998	MMBS11/1999			
				U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}
C.W. Rushing 1	5/16/91	12:07:44	12:08:56		0.198, -0.001	0.248, -0.009	0.483, -0.006				
Donnie Ray Jr. 1		12:22:50	12:24:30	*	0.386, -0.003	0.479, -0.017	0.481, 0.007	*			
Samantha		13:26:43	13:27:06	*	0.204, -0.002	0.257, -0.006	0.253, -0.008			0.308, -0.004	
C.W. Rushing 2	5/17/91	12:26:16	12:26:36	0.109, 0.016	0.199, 0.008	0.241, 0.011	0.257, 0.010	0.314, -0.001			
Jenco Towing		15:03:40	15:04:39	0.121, 0.014	0.197, 0.006	0.247, 0.010	0.278, -0.012	0.317, -0.014			
T.S. Kunsman		16:31:55	16:33:22	*	0.206, 0.008	0.264, 0.010	0.271, -0.010	0.337, -0.012			
Dell Butcher 1		17:43:27	17:46:12	0.110, 0.018	0.207, -0.020	0.249, -0.016	0.278, -0.012	0.324, -0.011			
Pearl B.	5/19/91	10:06:30	10:07:53	-	-	-	-	-			
Conti-Afton		11:41:08	11:42:35	-	-	-	-	-			
Jack D. Wofford		16:33:57	16:35:16	0.106, 0.002	0.213, 0.010	0.259, 0.011	0.205, -0.011	0.318, -0.010			
Donnie Ray Jr. 2	5/20/91	11:33:41	11:36:31	0.108, 0.005	0.210, 0.004	0.252, 0.012	0.199, 0.010	0.311, -0.012			
Sunflower 1		12:24:22	12:24:37	0.099, 0.005	0.209, 0.001	0.248, 0.012	0.202, 0.015	0.312, -0.007			
American Beauty 1		15:48:23	15:50:13	0.101, 0.009	0.209, 0.005	0.256, 0.013	0.202, 0.009	0.319, -0.010			
Sierra Dawn	5/21/91	09:09:28	09:11:00	0.113, 0.005	0.210, 0.011	0.246, 0.015	0.221, -0.009	0.319, 0.002			
Cooperative Vanguard		09:36:54	09:37:56	0.136, 0.001	0.212, 0.005	0.252, 0.011	0.203, -0.013	0.306, -0.004			
Cindy J. Erickson		10:29:26	10:31:47	0.134, 0.000	0.211, 0.010	0.249, 0.011	0.218, -0.011	0.314, -0.004			
Frank H. Peavy		10:49:16	10:50:37	0.129, -0.001	0.218, 0.010	0.257, 0.011	0.216, -0.009	0.311, -0.001			
Helen M. Clements		11:32:51	11:34:43	0.129, -0.001	0.209, 0.005	0.246, 0.012	0.209, -0.015	0.317, -0.009			
Sunflower 2		12:13:06	12:13:22	0.130, 0.001	0.206, 0.002	.246, 0.014	0.214, -0.016	0.324, -0.002			
Dell Butcher 2		12:37:20	12:38:44	0.132, -0.001	0.209, 0.004	0.248, 0.014	0.208, -0.014	0.307, -0.004			
Hornet		13:30:54	13:32:27	0.131, 0.001	0.211, 0.006	0.250, 0.013	0.209, -0.011	0.321, -0.003			
Volunteer State		16:08:16	16:09:56	0.128, 0.003	0.211, 0.004	0.247, 0.011	0.217, -0.012	0.323, -0.003			
Edward J. Hancock	5/22/91	09:52:51	09:55:33	*	0.205, 0.005	0.248, 0.011	*	0.312, -0.008			
Starfire		10:54:32	10:56:51	0.129, 0.004	0.211, 0.007	0.245, 0.009	*	0.313, -0.010			
American Beauty 2		13:46:39	13:47:10	0.139, 0.001	0.209, 0.010	0.243, 0.009	0.221, -0.017	0.317, -0.009			

- Meter was not available

* Meter did not work

Clarks Ferry Site, Trip 1 (Continued)

Tow name	Date	Passing Time		Mean ambient velocity m/s											
		Beginning	Ending	MMB511/1000		MMB527/332		MMB527/642		S4/151		S4/1834			
				U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}		
C.W. Rushing 1	5/16/91	12:07:44	12:08:56	0.698,-0.013		0.688,0.001		0.618,-0.011		*		-			
Donnie Ray Jr. 1		12:22:50	12:24:30	0.692,-0.010		0.613,0.003		0.637,-0.007		*		-			
Samantha		13:26:43	13:27:06	0.368,-0.002		0.687,-0.006		0.613,-0.011		*		-			
C.W. Rushing 2	5/17/91	12:26:16	12:26:36	0.344,0.011		0.495,0.002		*		*		0.287,0.143			
Jemco Towing		15:03:40	15:04:39	0.359,-0.011		0.498,-0.009		0.692,0.017		0.211,-0.066		0.166,0.092			
T.S. Kunsman		16:31:55	16:33:22	0.361,-0.010		0.489,0.011		0.646,-0.006		*		0.185,0.074			
Dell Butcher 1		17:43:27	17:46:12	0.341,-0.011		*		*		0.229,-0.054		0.254,0.133			
Pearl B.	5/19/91	10:06:30	10:07:53	-		0.497,0.001		0.508,-0.010		0.168,0.019		0.257,0.121			
Conti-Afton		11:41:08	11:42:35	-		0.524,-0.008		0.523,-0.011		0.178,0.017		0.271,0.126			
Jack D. Wofford		16:33:57	16:35:16	0.352,-0.013		0.515,0.000		0.507,-0.011		0.242,-0.014		0.388,0.168			
Donnie Ray Jr. 2	5/20/91	11:33:41	11:36:31	0.339,-0.014		0.474,0.016		0.493,-0.019		*		*			
Sunflower 1		12:24:22	12:24:37	0.344,-0.009		0.451,0.013		0.482,-0.008		*		*			
American Beauty 1		15:48:23	15:50:13	0.349,-0.010		0.481,0.017		0.473,-0.013		*		0.331,0.158			
Sierra Dawn	5/21/91	09:09:28	09:11:00	0.359,-0.006		-		-		*		*			
Cooperative Vanguard		09:36:54	09:37:56	0.343,-0.006		-		-		-		*			
Cindy J. Erickson		10:29:26	10:31:47	0.348,-0.009		-		-		-		*			
Frank H. Peavy		10:49:16	10:50:37	0.352,-0.010		-		-		-		*			
Helen M. Clements		11:32:51	11:34:43	0.361,-0.010		-		-		-		-			
Sunflower 2		12:13:06	12:13:22	0.363,-0.007		-		-		-		-			
Dell Butcher 2		12:37:20	12:38:44	0.348,-0.009		-		-		-		-			
Hornet		13:30:54	13:32:27	0.352,-0.009		-		-		-		-			
Volunteer State		16:08:16	16:09:56	0.371,-0.010		-		-		-		0.583,0.029			
Edward J. Hancock	5/22/91	09:52:51	09:55:33	0.349,-0.010		-		-		-		0.625,0.056			
Starfire		10:54:32	10:56:51	0.361,-0.015		-		-		-		0.623,0.043			
American Beauty 2		13:46:39	13:47:10	0.377,-0.017		-		-		-		0.615,0.021			

- Meter was not available

* Meter did not work

Clarks Ferry Site, Trip 1 (Concluded)

Tow name	Date	Passing Time		Mean ambient velocity m/s					
		Beginning	Ending	S4/040		S4/832		S4/071	
				U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}
C.W. Rushing 1	5/16/91	12:07:44	12:08:56	-	-	0.746, 0.029	-	-	-
Donnie Ray Jr. 1		12:22:50	12:24:30	-	-	0.798, 0.017	-	-	-
Samantha		13:26:43	13:27:06	-	-	0.754, 0.028	-	-	-
C.W. Rushing 2	5/17/91	12:26:16	12:26:36	*	*	0.321, 0.031	0.591, 0.058		
Jemco Towing		15:03:40	15:04:39	*	*	0.158, 0.021	0.645, 0.062		
T.S. Kunsman		16:31:55	16:33:22	*	*	*	0.584, 0.063		
Dell Butcher 1		17:43:27	17:46:12	*	*	0.210, 0.023	0.643, 0.067		
Pearl B.	5/19/91	10:06:30	10:07:53	*	*	0.209, 0.021	-		
Conti-Afton		11:41:08	11:42:35	*	*	0.216, 0.021	0.556, 0.063		
Jack D. Wofford		16:33:57	16:35:16	*	*	0.294, 0.027	0.547, 0.061		
Donnie Ray Jr. 2	5/20/91	11:33:41	11:36:31	0.639--0.007	*	*	*		
Sunflower 1		12:24:22	12:24:37	0.652, 0.014	*	*	*		
American Beauty 1		15:48:23	15:50:13	0.658, 0.003	0.252, 0.021	*	*		
Sierra Dawn	5/21/91	09:09:28	09:11:00	0.616, 0.017	0.268, 0.023	*	*		
Cooperative Vanguard		09:36:54	09:37:56	0.638, 0.016	*	*	-		
Cindy J. Erickson		10:29:26	10:31:47	0.627, 0.022	0.278, 0.023	-	-		
Frank H. Peavy		10:49:16	10:50:37	0.627, 0.016	*	*	-		
Helen M. Clements		11:32:51	11:34:43	0.643, 0.017	*	*	-		
Sunflower 2		12:13:06	12:13:22	0.619, 0.010	*	*	-		
Dell Butcher 2		12:37:20	12:38:44	0.621, 0.016	*	*	-		
Hornet		13:30:54	13:32:27	0.594, 0.012	*	*	-		
Volunteer State		16:08:16	16:09:56	0.603, 0.009	*	*	0.588, 0.064		
Edward J. Hancock	5/22/91	09:52:51	09:55:33	0.635, 0.019	0.237,-0.015	0.607, 0.066			
Starfire		10:54:32	10:56:51	0.603, 0.019	*	0.595, 0.061			
American Beauty 2		13:46:39	13:47:10	0.632, 0.021	0.199,-0.054	0.603, 0.058			

- Meter was not available
 * Meter did not work

Clarks Ferry Site, Trip 2

Tow name	Date	Passing Time		Mean ambient velocity m/s							
		Beginning	Ending	MMBS11/1001	MMBS11/998	MMBS11/999	MMBS11/1000	MMBS11/1000	MMBS11/1000	MMBS11/1000	MMBS11/1130
C.W. Rushing	10/17/91	07:33:54	07:34:17	U _{ma} 0.062, -0.005 V _{ma}	U _{ma} 0.091, -0.009 V _{ma}	U _{ma} 0.119, -0.006 V _{ma}	U _{ma} 0.129, 0.003 V _{ma}	U _{ma} 0.119, 0.005 V _{ma}	U _{ma} 0.131, -0.003 V _{ma}	U _{ma} 0.105, 0.015 V _{ma}	U _{ma} 0.132, 0.001 V _{ma}
Evey-T		08:43:43	08:45:34	0.061, -0.001	0.088, -0.008	0.110, -0.006	0.129, 0.003	0.119, 0.005	0.131, -0.003	0.106, 0.014	0.134, -0.002
Sunflower 1		11:43:54	11:44:12	0.055, -0.002	0.081, -0.003	0.110, -0.004	0.129, 0.003	0.119, 0.005	0.131, -0.003	0.106, 0.014	0.134, -0.002
Evelyn C.		11:45:01	11:45:36	0.053, -0.000	0.079, -0.002	0.111, -0.002	0.129, 0.003	0.119, 0.005	0.131, -0.003	0.105, 0.015	0.132, 0.001
Sunflower 2		17:06:09	17:06:35	0.053, N/A	0.099, 0.008	0.116, 0.008	0.129, 0.003	0.119, 0.005	0.131, -0.003	0.105, 0.015	0.132, 0.001
Conti-Nan 1		18:54:59	18:57:14	0.063, N/A	0.095, 0.004	0.116, 0.006	0.129, 0.003	0.119, 0.005	0.131, -0.003	0.105, 0.015	0.132, 0.001
Night 1		20:14:14	20:14:33	0.061, N/A	0.095, 0.007	0.112, 0.005	0.129, 0.003	0.119, 0.005	0.131, -0.003	0.105, 0.015	0.132, 0.001
Night 2		20:19:50	20:20:12	0.058, N/A	0.091, 0.006	0.109, 0.005	0.126, 0.010	0.119, 0.012	0.126, 0.010	0.121, -0.001	0.124, -0.001
Night 3		20:50:43	20:51:25	0.060, N/A	0.096, 0.006	0.116, 0.006	0.124, 0.009	0.117, 0.013	0.124, 0.009	0.124, -0.001	0.124, -0.001
Lady Lone Star 1	10/18/91	07:16:51	07:17:25	0.049, N/A	0.085, 0.006	0.107, 0.002	0.116, 0.008	0.117, 0.004	0.121, 0.009	0.113, -0.005	0.113, -0.005
Lady Lone Star 2		07:43:37	07:43:44	0.049, N/A	0.081, 0.004	0.111, 0.004	0.121, 0.009	0.117, 0.004	0.121, 0.009	0.117, -0.004	0.117, -0.004
Kevin Michael		08:24:59	08:27:08	0.048, N/A	0.083, 0.004	0.110, 0.003	0.123, 0.006	0.111, 0.002	0.123, 0.006	0.111, -0.002	0.111, -0.002
Deborah Valentine		09:55:28	09:58:08	0.049, N/A	0.062, 0.002	0.109, 0.005	0.116, 0.009	0.116, 0.009	0.116, 0.009	0.116, -0.002	0.116, -0.002
Volunteer State		10:06:34	10:07:14	0.051, N/A	0.067, 0.001	0.116, 0.005	0.130, 0.011	0.130, 0.011	0.130, 0.011	0.126, -0.001	0.126, -0.001
Sunflower 3		11:26:47	11:27:04	0.047, N/A	0.055, 0.001	0.106, 0.006	0.119, 0.012	0.119, 0.012	0.119, 0.012	0.116, -0.004	0.116, -0.004
Frank Stegbauer		12:32:08	12:32:52	0.050, N/A	0.057, 0.000	0.109, 0.004	0.117, 0.013	0.117, 0.013	0.117, 0.013	0.113, -0.002	0.113, -0.002
Kathy Ellen	10/19/91	10:13:44	10:16:43	0.054, -0.016	0.085, N/A	0.116, 0.005	0.130, 0.009	0.130, 0.009	0.130, 0.009	0.124, -0.001	0.124, -0.001
Jack Bullard		12:07:14	12:09:42	0.072, -0.006	0.093, 0.005	0.108, 0.002	0.121, 0.009	0.121, 0.009	0.121, 0.009	0.124, 0.000	0.124, 0.000
Marc		12:57:38	12:58:29	0.069, -0.005	0.101, 0.005	0.115, 0.005	0.123, 0.010	0.123, 0.010	0.123, 0.010	0.119, 0.001	0.119, 0.001
Conti-Nan 2		13:44:23	13:45:17	0.064, -0.004	0.091, 0.007	0.106, 0.004	0.119, 0.010	0.119, 0.010	0.119, 0.010	0.126, -0.001	0.126, -0.001
Cristina Ecstein		14:03:17	14:04:18	0.069, -0.007	0.099, 0.006	0.106, 0.004	0.125, 0.007	0.125, 0.007	0.125, 0.007	0.118, -0.001	0.118, -0.001
Coast Guard 65504		14:54:46	14:54:57	0.070, -0.004	0.099, 0.005	0.111, 0.004	0.129, 0.006	0.129, 0.006	0.129, 0.006	0.125, -0.001	0.125, -0.001
Prairie Dawn		17:30:03	17:31:27	0.061, 0.001	0.101, 0.005	0.109, 0.005	0.120, 0.008	0.120, 0.008	0.120, 0.008	0.120, 0.001	0.120, 0.001
Noname	10/20/91	06:54:14	06:55:25	*	0.094, 0.003	0.104, 0.001	0.123, 0.006	0.123, 0.006	0.123, 0.006	*	*
Coop. Ambassador		07:05:14	07:07:29	0.049, 0.003	0.096, 0.004	0.114, 0.000	0.124, 0.006	0.124, 0.006	0.124, 0.006	0.121, -0.003	0.121, -0.003
Yazoo City		09:31:48	09:34:30	0.056, 0.001	0.091, 0.005	0.109, 0.001	0.130, 0.006	0.130, 0.006	0.130, 0.006	0.116, 0.002	0.116, 0.002
George W. Banta		12:19:36	12:21:59	0.054, 0.001	0.092, 0.005	0.109, 0.004	0.122, 0.006	0.122, 0.006	0.122, 0.006	0.119, 0.000	0.119, 0.000

- Meter was not available
* Meter did not work

Clarks Ferry Site, Trip 2 (Continued)

Tow name	Date	Passing Time		Mean ambient velocity m/s						S4/834	
		Beginning	Ending	U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}
C.W. Rushing	10/17/91	07:33:54	07:34:17	0.137, 0.009	0.233, 0.002	0.233, 0.001	0.245, -0.002	0.238, -0.001	-	-	-
Evey-T		08:43:43	08:45:34	0.138, 0.007	0.233, 0.001	0.218, 0.010	0.232, 0.001	0.238, 0.004	*	*	*
Sunflower 1		11:43:54	11:44:12	0.124, 0.015	0.218, 0.007	0.253, -0.011	0.261, -0.001	0.263, -0.011	*	*	*
Evelyn C.		11:45:01	11:45:36	0.124, 0.010	0.253, -0.011	0.254, -0.003	0.238, -0.006	0.235, -0.010	*	*	*
Sunflower 2		17:06:09	17:06:35	0.145, -0.000	0.238, -0.006	0.241, 0.001	0.242, 0.009	0.331, 0.049	*	*	*
Conti-Nan 1		18:54:59	18:57:14	0.146, -0.003	0.231, -0.002	0.227, -0.002	0.238, -0.010	0.409, 0.003	*	*	*
Night 1		20:14:14	20:14:33	0.131, -0.004	0.223, -0.003	0.229, -0.002	0.229, -0.140	0.418, 0.004	*	*	*
Night 2		20:19:50	20:20:12	0.133, -0.004	0.229, -0.002	0.241, -0.000	0.238, -0.010	0.417, -0.001	*	*	*
Night 3		20:50:43	20:51:25	0.140, -0.003	0.230, -0.006	0.227, -0.005	0.236, -0.011	0.401, -0.001	*	*	*
Lady Lone Star 1	10/18/91	07:16:51	07:17:25	0.129, -0.005	0.241, -0.001	0.241, -0.004	0.233, -0.004	0.408, 0.016	*	*	*
Lady Lone Star 2		07:43:37	07:43:44	0.133, -0.004	0.241, -0.004	0.241, 0.001	0.246, -0.009	0.391, 0.016	*	*	*
Kevin Michael		08:24:59	08:27:08	0.126, -0.003	0.241, 0.001	0.241, 0.006	0.248, -0.008	0.409, 0.004	*	*	*
Deborah Valentine		09:55:28	09:58:08	0.131, -0.005	0.241, 0.006	0.238, 0.010	0.253, -0.006	0.381, 0.018	*	*	*
Volunteer State		10:06:34	10:07:14	0.140, -0.004	0.238, 0.010	0.243, 0.001	0.249, -0.010	0.378, 0.024	*	*	*
Sunflower 3		11:26:47	11:27:04	0.131, -0.006	0.243, 0.001	0.231, 0.002	0.249, -0.005	0.384, 0.016	*	*	*
Frank Stegbauer		12:32:08	12:32:52	0.131, -0.005	0.231, -0.005	0.238, -0.010	0.259, -0.011	0.402, 0.002	*	*	*
Kathy Ellen	10/19/91	10:13:44	10:16:43	0.142, -0.004	0.241, -0.001	0.241, -0.004	0.246, -0.009	0.408, 0.016	*	*	*
Jack Bullard		12:07:14	12:09:42	0.133, -0.004	0.241, -0.004	0.241, 0.001	0.248, -0.008	0.391, 0.016	*	*	*
Marc		12:57:38	12:58:29	0.135, -0.004	0.241, 0.001	0.241, 0.006	0.253, -0.006	0.409, 0.004	*	*	*
Conti-Nan 2		13:44:23	13:45:17	0.136, -0.004	0.241, 0.006	0.238, 0.010	0.249, -0.010	0.381, 0.018	*	*	*
Cristina Ecstein		14:03:17	14:04:18	0.135, -0.004	0.238, 0.010	0.243, 0.001	0.249, -0.005	0.378, 0.024	*	*	*
Coast Guard 65504		14:54:46	14:54:57	0.144, -0.003	0.243, 0.001	0.231, 0.002	0.249, -0.005	0.384, 0.016	*	*	*
Prairie Dawn		17:30:03	17:31:27	0.134, -0.005	0.231, 0.002	0.238, 0.002	0.259, -0.011	0.402, 0.002	*	*	*
Noname	10/20/91	06:54:14	06:55:25	*	0.238, 0.002	0.233, -0.001	*	0.408, 0.005	*	*	*
Coop. Ambassador		07:05:14	07:07:29	0.140, -0.002	0.233, -0.001	0.238, 0.001	0.247, -0.010	0.388, 0.012	*	*	*
Yazoo City		09:31:48	09:34:30	0.128, -0.006	0.238, 0.001	0.242, 0.001	0.241, 0.001				
George W. Banta		12:19:36	12:21:59	0.135, -0.004	0.242, 0.001						

- Meter was not available
* Meter did not work

Clarks Ferry Site, Trip 2 (Concluded)

Tow name	Date	Passing Time		Mean ambient velocity m/s					
		Beginning	Ending	S4/151		S4/832		S4/040	
				U _{ma}	V _{ma}	U _{ma}	V _{ma}	U _{ma}	V _{ma}
C.W. Rushing	10/17/91	07:33:54	07:34:17	-	-	-	-	-	-
Evey-T		08:43:43	08:45:34	-	-	-	-	-	-
Sunflower 1		11:43:54	11:44:12	0.299, 0.056		0.237, 0.011		*	*
Evelyn C.		11:45:01	11:45:36	0.300, 0.057		0.243, 0.011		*	*
Sunflower 2		17:06:09	17:06:35	0.342, 0.068		0.293, 0.006		-	-
Conti-Nan 1		18:54:59	18:57:14	0.328, 0.060		0.298, 0.014		0.131, -0.002	
Night 1		20:14:14	20:14:33	0.308, 0.052		0.280, 0.006		0.151, -0.000	
Night 2		20:19:50	20:20:12	0.319, 0.053		0.288, 0.005		*	*
Night 3		20:50:43	20:51:25	0.313, 0.054		0.279, 0.010		0.131, 0.002	
Lady Lone Star 1	10/18/91	07:16:51	07:17:25	0.306, 0.054		0.258, 0.010		*	*
Lady Lone Star 2		07:43:37	07:43:44	0.303, 0.054		0.262, 0.011		*	*
Kevin Michael		08:24:59	08:27:08	0.301, 0.051		0.269, 0.011		*	*
Deborah Valentine		09:55:28	09:58:08	0.298, 0.048		0.267, 0.008		*	*
Volunteer State		10:06:34	10:07:14	0.312, 0.048		0.278, -0.002		*	*
Sunflower 3		11:26:47	11:27:04	-	-	-	-	*	*
Frank Stegbauer		12:32:08	12:32:52	0.308, 0.043		0.256, 0.000		*	*
Kathy Ellen	10/19/91	10:13:44	10:16:43	0.319, 0.060		0.273, 0.014		*	*
Jack Bullard		12:07:14	12:09:42	0.303, 0.059		*		0.196, 0.012	
Marc		12:57:38	12:58:29	0.310, 0.061		0.292, 0.012		*	*
Conti-Nan 2		13:44:23	13:45:17	0.308, 0.059		0.281, 0.009		*	*
Cristina Ecstein		14:03:17	14:04:18	0.296, 0.041		0.258, 0.006		*	*
Coast Guard 65504		14:54:46	14:54:57	0.302, 0.058		0.271, 0.006		0.173, 0.010	
Prairie Dawn		17:30:03	17:31:27	0.298, 0.061		0.277, 0.011		0.143, 0.005	
Noname	10/20/91	06:54:14	06:55:25	0.298, 0.051		0.287, 0.011		*	*
Coop. Ambassador		07:05:14	07:07:29	0.301, 0.060		0.294, 0.016		*	*
Yazoo City		09:31:48	09:34:30	0.301, 0.053		0.260, 0.015		*	*
George W. Banta		12:19:36	12:21:59	0.300, 0.057		0.283, 0.014		*	*

- Meter was not available
 * Meter did not work

APPENDIX XI.

**INDUCED VELOCITY AT ALL SITES AND ALL METERING LOCATIONS
DURING BARGE-TOW PASSAGE**

McEver's Island Site

	Tow name	Date	Passing Time		Induced velocity m/s					
			Beginning	Ending	MMBS11/998	MMBS11/999	MMBS11/1000	MMBS11/1001	MMBS11/1002	MMBS11/1003
	R. W. Naye	5/16/89	14:23:30	14:26:32	U _{im} 0.440, 0.038	U _{im} -	U _{im} -	U _{im} -	U _{im} -	U _{im} -
	Evelyn C.		14:46:35	14:46:45	*	-	-	-	-	-
	Mary Ellen	5/17/89	7:57:10	7:59:50	0.485, 0.058	-	-	-	-	-
	Elaine Jones		8:07:00	8:09:22	*	-	-	-	-	-
	Nicholas Duncan		15:29:38	15:33:40	0.550, **	-	-	-	-	-
	Mobil Leader	5/18/89	9:39:47	9:41:21	-	0.385, 0.036	0.325, 0.025	0.325, 0.025	0.325, 0.025	0.325, 0.025
	Reliance		12:16:45	12:19:13	0.400, 0.055	0.310, 0.032	0.243, 0.021	0.243, 0.021	0.243, 0.021	0.243, 0.021
	Cooperative Vanguard		12:41:49	12:44:03	-0.355, -0.127	-0.135, -0.046	-0.120, -0.043	-0.120, -0.043	-0.120, -0.043	-0.120, -0.043
	Marvin Norman		13:09:20	13:11:27	0.170, 0.030	0.190, 0.024	0.138, 0.020	0.138, 0.020	0.138, 0.020	0.138, 0.020
	Illini		14:31:36	14:33:34	-0.270, -0.055	-0.062, -0.030	-0.080, -0.032	-0.080, -0.032	-0.080, -0.032	-0.080, -0.032
	Thurston B. Morton	5/19/89	10:37:56	10:40:40	-	-0.025, -0.035	-0.050, -0.028	-0.050, -0.028	-0.050, -0.028	-0.050, -0.028
	Clarence G. Frame		10:45:36	10:47:40	-	-0.120, -0.045	-0.110, -0.035	-0.110, -0.035	-0.110, -0.035	-0.110, -0.035

	Tow name	Date	Passing Time		Induced velocity m/s			
			Beginning	Ending	MMBS27/642	S4/071	U _{im}	V _{im}
	R. W. Naye	5/16/89	14:23:30	14:26:32	U _{im} 0.640, 0.028	U _{im} 0.210, 0.040	0.210, 0.040	0.210, 0.040
	Evelyn C.		14:46:35	14:46:45	*	*	*	*
	Mary Ellen	5/17/89	7:57:10	7:59:50	0.885, **	0.223, 0.008	0.223, 0.008	0.223, 0.008
	Elaine Jones		8:07:00	8:09:22	*	*	*	*
	Nicholas Duncan		15:29:38	15:33:40	**	-	-	-
	Mobil Leader	5/18/89	9:39:47	9:41:21	-	0.135, 0.050	0.135, 0.050	0.135, 0.050
	Reliance		12:16:45	12:19:13	0.555, 0.054	0.120, **	0.120, **	0.120, **
	Cooperative Vanguard		12:41:49	12:44:03	-0.429, -0.104	-0.062, -0.051	-0.062, -0.051	-0.062, -0.051
	Marvin Norman		13:09:20	13:11:27	0.265, 0.030	0.127, 0.040	0.127, 0.040	0.127, 0.040
	Illini		14:31:36	14:33:34	-0.235, -0.065	-	-	-
	Thurston B. Morton	5/19/89	10:37:56	10:40:40	-	*	*	*
	Clarence G. Frame		10:45:36	10:47:40	-	-0.028, 0.000	-0.028, 0.000	-0.028, 0.000

- Meter was not available
* Meter did not work

Kampsville Site, Trip 1

Tow name	Date	Passing time		Induced velocity m/s									
		Beginning	Ending	MMB511/1001	MMB511/998	MMB511/999	MMB511/1000	MMB511/642					
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
Mr. Aldo	10/12/90	13:34:46	13:36:48	*									
Floyd Blaske		13:47:57	13:50:10	*									
Marvin Norman	10/13/90	09:31:13	09:34:45	0.281, **									
Luke Burton		09:55:32	09:56:38	0.432, **									
Sugarland		09:58:35	10:01:18	0.381, **									
William C. Norman		11:08:41	11:10:15	0.033, 0.014									
Frank H. Peavey		15:20:29	15:24:20	0.380, 0.025									
Conti Karla		16:23:56	16:27:38	0.435, -0.029									
Mr. Paul	10/14/90	10:17:12	10:18:58	0.080, **									
Rambler		10:56:37	10:58:25	0.075, **									
Mr. Lawrence		11:42:09	11:44:22	0.490, **									
Mallard		12:25:38	12:26:51	0.352, **									
Charles Lehman		13:28:18	13:31:24	0.438, -0.030									
Nicholas Duncan		15:29:11	15:31:36	0.430, **									
Jeff Boat		15:57:43	16:00:46	0.476, -0.033									
Mary Ann		16:36:20	16:39:11	0.292, **									
Ardyce Randall	10/15/90	09:49:07	09:51:32	0.120, **									
Mr. Paul		12:07:21	12:09:53	0.441, -0.024									
Exxon St. Louis		14:51:40	14:53:18	0.441, **									
Margaret O.		15:11:17	15:12:29	-0.070, **									
Mr. Lawrence		18:10:53	18:12:36	-0.007, **									
A.L. Smith	10/16/90	10:27:27	10:29:00	0.178, **									
Ste. Genevieve		16:19:41	16:22:00	0.348, -0.025									
Nicole Brent	10/17/90	10:25:21	10:26:31	0.355, **									
Frank H. Peavey		11:14:06	11:15:20	0.090, 0.025									

* Meter did not work

**No obvious impact

Kampsville Site, Trip 1 (Concluded)

Tow name	Date	Passing time		Induced velocity m/s			
		Beginning	Ending	MMB511/332	MMB527/040	MMB527/071	
				U_{im}	V_{im}	U_{im}	V_{im}
Mr. Aldo	10/12/90	13:34:46	13:36:48	0.180, 0.070	0.209, 0.101	0.240, 0.034	
Floyd Blaske		13:47:57	13:50:10	0.847, 0.046	0.760, 0.089	0.750, 0.060	
Marvin Norman	10/13/90	09:31:13	09:34:45	0.665, **	*	0.497, **	
Luke Burton		09:55:32	09:56:38	0.803, 0.065	*	0.612, **	
Sugarland		09:58:35	10:01:18	0.837, 0.065	*	0.631, **	
William C. Norman		11:08:41	11:10:15	0.263, 0.072	0.235, 0.165	0.229, 0.070	
Frank H. Peavey		15:20:29	15:24:20	0.782, 0.064	0.793, 0.187	0.697, 0.054	
Conti Karla		16:23:56	16:27:38	0.810, 0.071	0.720, 0.160	0.708, 0.047	
Mr. Paul	10/14/90	10:17:12	10:18:58	0.310, 0.025	*	0.303, 0.038	
Rambler		10:56:37	10:58:25	0.320, 0.450	0.278, 0.140	*	
Mr. Lawrence		11:42:09	11:44:22	0.900, 0.050	0.740, 0.145	0.690, 0.037	
Mallard		12:25:38	12:26:51	0.704, 0.026	0.687, 0.159	0.577, 0.052	
Charles Lehman		13:28:18	13:31:24	0.870, 0.050	0.800, 0.161	0.700, 0.061	
Nicholas Duncan		15:29:11	15:31:36	0.830, 0.044	0.741, 0.163	0.640, 0.068	
Jeff Boat		15:57:43	16:00:46	0.895, 0.074	0.765, 0.155	0.735, 0.067	
Mary Ann		16:36:20	16:39:11	0.663, **	0.568, 0.081	0.585, 0.040	
Ardyce Randall	10/15/90	09:49:07	09:51:32	0.380, 0.067	0.298, 0.158	0.345, 0.024	
Mr. Paul		12:07:21	12:09:53	0.845, 0.099	0.728, 0.118	0.659, 0.034	
Exxon St. Louis		14:51:40	14:53:18	0.924, 0.092	0.817, 0.258	*	
Margaret O.		15:11:17	15:12:29	0.113, -0.170	-0.031, 0.180	0.180, 0.058	
Mr. Lawrence		18:10:53	18:12:36	0.201, 0.070	*	*	
A.L. Smith	10/16/90	10:27:27	10:29:00	0.455, **	0.338, **	0.421, **	
Ste. Genevieve		16:19:41	16:22:00	0.680, 0.022	0.590, 0.060	0.538, **	
Nicole Brent	10/17/90	10:25:21	10:26:31	0.681, 0.030	0.690, 0.093	0.605, 0.040	
Frank H. Peavey		11:14:06	11:15:20	0.240, 0.035	0.158, 0.144	0.277, 0.052	

* Meter did not work

** No obvious impact

Kampsville Site, Trip 2

Tow name	Date	Passing Time		Induced velocity m/s					
		Beginning	Ending	MMB511/1001		MMB511/998		MMB511/999	
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
Ranger	8/13/91	10:08:48	10:10:32	*	*	*	*	0.047, -0.012	
Dixie Patriot		10:48:40	10:50:01	*	*	0.002, **		-0.120, **	
Orleanian		16:39:53	16:42:40	0.261, **		*		0.361, **	
Pat Breen		17:45:36	17:47:58	-0.107, **		*		-0.109, -0.006	
Dixie Express		18:15:23	18:16:04	-0.059, 0.085		*		-0.031, -0.020	
Night-14-01	8/14/91	04:21:06	04:23:57	0.329, **		*		0.342, **	
Night-14-02		07:15:57	07:16:51	-0.005, 0.029		*		0.035, -0.009	
Irving Crown		10:08:34	10:10:45	0.236, **		0.185, N/A		0.389, **	
George W. Shamblyn		13:16:16	13:16:56	0.039, **		*		0.058, **	
Katherine L.		13:26:36	13:27:20	0.008, 0.026		0.121, **		0.075, **	
Thruston B. Morton		14:21:58	14:23:57	0.306, **		*		0.393, **	
Julie White		14:32:12	14:35:45	0.182, 0.016		*		0.272, **	
Ranger		17:07:52	17:08:16	0.156, 0.011		*		**	
Illini		19:12:43	19:14:43	0.165, **		*		0.197, **	
Bronwynne Brent		19:23:50	19:25:19	-0.051, **		*		-0.008, 0.004	
Bill McCormick	8/15/91	00:02:15	00:04:28	-0.151, 0.021		*		*	
Marvin E. Norman		03:27:22	03:29:18	-0.082, 0.018		*		*	
Olmstead		13:02:42	13:05:16	0.362, **		0.273, -0.100		0.478, **	
Jack D. Wofford		13:39:18	13:41:57	0.375, **		0.286, **		0.461, -0.065	
Dixie Express		15:09:12	15:10:08	0.251, **		0.200, **		0.291, **	
Hal D. Miller		17:45:56	17:46:56	-0.129, 0.081		-0.100, **		-0.086, **	
Jesse Brent		18:10:31	18:10:55	-0.029, 0.080		0.001, -0.015		0.027, -0.044	

* Meter did not work

**No obvious impact

Kampsville Site, Trip 2 (Concluded)

Tow name	Date	Passing Time		Induced velocity m/s					
		Beginning	Ending	MMBS11/1000		MMBS27/642		MMBS27/332	
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
Ranger	8/13/91	10:08:48	10:10:32	*		0.002, N/A		0.051, 0.030	
Dixie Patriot		10:48:40	10:50:01	0.293, **		-0.071, 0.036		-0.128, 0.029	
Orleanian		16:39:53	16:42:40	*		0.362, 0.015		0.393, 0.081	
Pat Breen		17:45:36	17:47:58	*		-0.113, **		-0.090, 0.051	
Dixie Express		18:15:23	18:16:04	*		-0.027, 0.022		-0.009, 0.020	
Night-14-01	8/14/91	04:21:06	04:23:57	*		0.375, **		0.407, 0.091	
Night-14-02		07:15:57	07:16:51	*		0.032, **		0.061, 0.017	
Irving Crown		10:08:34	10:10:45	*		0.338, 0.073		0.340, 0.047	
George W. Shamblin		13:16:16	13:16:56	*		*		0.066, 0.024	
Katherine L.		13:26:36	13:27:20	**	**	*		0.075, 0.023	
Thruston B. Morton		14:21:58	14:23:57	*		*		0.450, 0.101	
Julie White		14:32:12	14:35:45	*		*		0.336, 0.050	
Ranger		17:07:52	17:08:16	*		*		**	**
Illini		19:12:43	19:14:43	**	**	*		0.251, 0.051	
Bronwynne Brent		19:23:50	19:25:19	**	**	*		-0.002, 0.029	
Bill McCormick	8/15/91	02:12:55	04:28:20	*		*		-0.125, 0.046	
Marvin E. Norman		03:27:22	03:29:18	*		*		-0.039, 0.063	
Olmstead		13:02:42	13:05:16	0.085, **		*		0.503, 0.123	
Jack D. Wofford		13:39:18	13:41:57	*		*		0.500, 0.108	
Dixie Express		15:09:12	15:10:08	*		0.301, 0.010		0.371, 0.069	
Hal D. Miller		17:45:56	17:46:56	*		-0.076, 0.020		-0.088, 0.045	
Jesse Brent		18:10:31	18:10:55	*		0.021, 0.037		0.030, 0.029	

* Meter did not work

**No obvious impact

Apple River Island Site

Tow name	Date	Passing Time		Induced velocity m/s							
		Beginning	Ending	MMB511/1001	MMB511/1000	MMB511/998	MMB527/642	MMB527/332			
Yazoo Cooperative Ambassador Christine Bailey Kathy Ellen	5/18/90	16:20:16	16:23:41	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
		16:46:42	16:48:55	0.307, 0.005	0.343, -0.037	0.523, 0.089	**	0.464, 0.011	0.193, 0.011	0.267, 0.012	0.071, **
		17:21:24	17:23:17	0.451, -0.040	0.412, -0.056	*	*	0.185, -0.016	0.241, 0.010		
		20:07:30	20:09:39	0.123, -0.025	0.168, -0.030	*	*	0.329, 0.011			
W.A. Kernan Hornet Conti-Bonnie Becky Lynn	5/19/90	10:04:10	10:07:04	0.317, 0.006	0.330, -0.014						
		11:20:37	11:21:31	0.332, 0.008	0.342, -0.035	0.379, 0.092	0.291, 0.040	**			
		11:40:41	11:42:25	0.156, -0.015	0.193, -0.030	0.337, -0.051	**	0.046, -0.021			
		11:56:12	11:58:03	0.312, 0.020	0.304, -0.002	0.417, 0.054	**	0.156, **			
Merlin Banta Rusty Flowers Tom Talbert Herman Pott	5/20/90	09:09:21	09:10:12	0.301, 0.012	0.300, -0.012	0.428, 0.076	0.268, 0.006	**			
		11:27:57	11:29:38	0.189, -0.006	0.192, -0.005	*	0.090, 0.052	0.007, -0.026			
		12:36:12	12:37:48	0.299, 0.030	0.328, -0.011	0.441, 0.051	0.173, 0.069	*			
		15:33:19	15:35:31	0.320, 0.016	0.338, -0.041	**	**	*			
Walter Brunson Dell Butcher Mary Gail T.S. Kunsman D. Ray Miller	5/21/90	10:06:14	10:08:09	0.453, **	0.391, -0.014	0.462, 0.149	0.113, 0.193	*			
		11:00:40	11:02:30	0.308, 0.008	0.323, -0.011	*	**	0.529, 0.053			
		14:19:17	14:20:01	0.131, 0.019	0.182, **	**	0.349, -0.051	0.298, -0.046			
		14:37:15	14:38:33	0.306, 0.019	0.288, -0.010	**	**	0.421, 0.016			
Mary Gail Trojan Melinda Brent Corporate Mariner Ed Renshaw	5/22/90	14:55:21	14:57:23	0.151, -0.016	0.152, -0.026	**	0.357, -0.061	0.314, -0.055			
		10:09:50	10:10:25	0.400, 0.002	0.352, **	0.528, 0.149	0.718, 0.085	0.570, **			
		17:08:42	17:09:52	0.153, **	0.221, -0.029	*	0.386, -0.046	0.266, -0.036			
		17:28:40	17:29:27	0.180, -0.019	0.191, -0.002	**	0.381, -0.050	0.269, -0.060			
Kevin Michael Jack D. Wofford Trojan	5/23/90	18:06:22	18:07:30	**	**	**	**	0.431, -0.053			
		06:52:42	06:55:13	0.141, -0.045	0.130, -0.035	*	0.316, 0.019	0.182, -0.051			
		16:13:23	16:14:20	-	-	-	-	-			
		16:23:20	16:24:42	0.320, 0.026	0.263, **	**	**	0.359, 0.021			

- Meter was not available
 * Meter did not work
 **No obvious impact

Apple River Island Site (Concluded)

Tow name	Date	Passing Time		Induced velocity m/s					
				MMBS11/999			S4/071		
		Beginning	Ending	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
Yazoo	5/18/90	16:20:16	16:23:41	*		-		-	
Cooperative Ambassador		16:46:42	16:48:55	*		-		-	
Christine Bailey		17:21:24	17:23:17	*		-		-	
Kathy Ellen		20:07:30	20:09:39	*		-		-	
W.A. Kernan	5/19/90	10:04:10	10:07:04	*		**		-	
Hornet		11:20:37	11:21:31	*		**		-	
Conti-Bonnie		11:40:41	11:42:25	*		0.754, -0.029		-	
Becky Lynn		11:56:12	11:58:03	*		**		-	
Merlin Banta	5/20/90	09:09:21	09:10:12	*		-		**	
Rusty Flowers		11:27:57	11:29:38	*		-		*	
Tom Talbert		12:36:12	12:37:48	*		-		0.751, 0.080	
Herman Pott		15:33:19	15:35:31	*		0.964, 0.100		*	
Walter Brunson	5/21/90	10:06:14	10:08:09	*		0.698, -0.046		*	
Dell Butcher		11:00:40	11:02:30	*		0.372, -0.010		*	
Mary Gail		14:19:17	14:20:01	*		-		**	
T.S. Kunsman		14:37:15	14:38:33	*		0.392, -0.036		0.267, 0.039	
D. Ray Miller		14:55:21	14:57:23	*		0.726, -0.009		0.775, -0.004	
Mary Gail	5/22/90	10:09:50	10:10:25	*		0.458, -0.140		**	
Trojan		17:08:42	17:09:52	*		0.494, -0.021		0.481, -0.016	
Merlinda Brent		17:28:40	17:29:27	*		**		*	
Corporate Mariner		18:06:22	18:07:30	*		0.401, -0.046		*	
Ed Renshaw		19:49:48		*		*		0.804, -0.020	
Kevin Michael	5/23/90	06:52:42	06:55:13	*		-		**	
Jack D. Wofford		16:13:23	16:14:20	*		-		**	
Trojan		16:23:20	16:24:42	*		-		-	

- Meter was not available

* Meter did not work

**No obvious impact

Goose Island Site, Trip 1

Tow name	Date	Passing Time		Induced velocity m/s											
		Beginning	Ending	MMB511/1001	MMB511/998	MMB511/999	MMB511/1000	MMB527/642							
Sierra Dawn	8/24/90	10:51:08	10:52:54	U_{im} 0.297, 0.050	U_{im} 0.353, -0.015	U_{im} 0.397, -0.021	U_{im} 0.241, -0.006	U_{im} 0.289, -0.055							
Dell Butcher		13:42:01	13:43:52	0.317, **	0.321, **	0.362, **	0.242, **	0.292, -0.056							
William C. Norman		13:54:34	13:57:35	**	0.446, **	0.478, -0.010	0.314, 0.010	0.468, 0.013							
Normania		14:16:33	14:20:50	0.532, 0.081	0.425, **	0.468, -0.010	0.320, **	0.451, 0.046							
Dave Carlton		16:39:17	16:40:57	0.316, **	0.318, **	0.346, -0.036	0.204, -0.025	*							
Hugh C. Blaske	8/25/90	11:19:46	11:22:52	0.657, 0.200	0.488, **	0.578, -0.010	0.371, 0.006	0.679, 0.034							
Teresa Renee B.		12:15:45	12:17:17	0.248, -0.070	0.271, **	0.334, -0.036	0.198, -0.029	0.328, -0.035							
Trojan Warrior		12:24:48	12:26:28	0.578, 0.150	0.457, **	0.568, -0.009	0.372, -0.030	0.681, **							
Hoosier State		15:45:01	15:47:01	0.522, 0.142	0.416, **	0.469, -0.010	0.316, 0.025	0.614, 0.045							
Kevin Michael	8/26/90	11:46:36	11:48:36	-	0.331, **	0.412, **	0.229, -0.014	-							
Sumac		13:27:02	13:27:21	-	0.317, -0.024	0.370, 0.001	0.212, -0.038	-							
Twin City		14:21:22	14:24:00	-	0.428, **	0.528, **	0.343, 0.020	-							
Cooperative Vanguard		14:58:35	15:01:11	-	**	0.501, 0.020	0.305, 0.020	-							
Superior	8/27/90	9:54:38	9:58:22	-	0.474, -0.009	**	*	-							
Helen M. Clements		12:36:11	12:38:32	-	**	**	0.325, **	-							

- Meter was not available

* Meter did not work

** No obvious impact

Goose Island Site, Trip 1 (Concluded)

Tow name	Date	Passing Time		Induced velocity m/s			
		Beginning	Ending	MMB527/332		S4/071	
				U_{im}	V_{im}	U_{im}	V_{im}
Sierra Dawn	8/24/90	10:51:08	10:52:54	0.291, -0.034	0.348, -0.058	0.261, 0.011	0.651, 0.178
Dell Butcher		13:42:01	13:43:52	0.341, -0.056	0.100, -0.100	0.673, 0.201	-
William C. Norman		13:54:34	13:57:35	0.447, 0.090	0.589, 0.008	0.767, 0.218	0.714, 0.218
Normania		14:16:33	14:20:50	0.381, 0.056	*	0.681, 0.112	0.218, -0.019
Dave Carlton		16:39:17	16:40:57	0.150, **	0.294, -0.052		
Hugh C. Blaske	8/25/90	11:19:46	11:22:52	0.248, 0.024	0.627, 0.079		
Teresa Renee B.		12:15:45	12:17:17	0.056, **	*		
Trojan Warrior		12:24:48	12:26:28	0.163, 0.006	0.707, -0.007		
Hoosier State		15:45:01	15:47:01	0.307, 0.024	**		
Kevin Michael	8/26/90	11:46:36	11:48:36	-	*		
Sumac		13:27:02	13:27:21	-	*		
Twin City		14:21:22	14:24:00	-	-		
Cooperative Vanguard		14:58:35	15:01:11	-	-		
Superior	8/27/90	9:54:38	9:58:22	-	-		
Helen M. Clements		12:36:11	12:38:32	-	-		

- Meter was not available

* Meter did not work

** No obvious impact

Goose Island Site, Trip 2

Tow name	Date	Passing Time		Induced velocity m/s											
		Beginning	Ending	MMBS11/1001	MMBS11/1130	MMBS11/1131	MMBS11/998	MMBS11/999							
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
Ardyce Randall	7/18/91	10:42:18	10:44:10		0.036, -0.017	0.010, -0.014		-0.041, 0.036							
Scarlet Knight		12:26:59	12:28:46	0.245, -0.026	**	**	**	-0.007, -0.10							
James F. Neal		14:17:04	14:18:34	0.208, -0.027	0.104, **	0.181, -0.011	**	-0.008, 0.002							
Helen M. Clements		17:23:03	17:25:22	**	**	**	**	0.069, -0.007							
Elizabeth Ann		18:00:59	18:02:46	-	-	-	-	-							
Frank T. Heffelfinger	7/19/91	11:03:32	11:05:24	**	0.094, 0.001	0.157, -0.005	**	-0.030, 0.011							
Queen City		14:33:45	14:35:21	0.202, **	0.078, -0.003	0.129, 0.014	**	*							
Helen M. Clements		16:24:27	16:26:12	0.194, -0.010	0.081, 0.001	0.133, **	*	**							
Frank T. Heffelfinger		16:33:21	16:36:52	0.327, 0.005	**	**	*	0.036, **							
Cooperative Venture		18:05:37	18:56:45	**	**	**	*	*							
Volunteer State		08:09:31	08:11:39	0.195, **	0.061, 0.013	0.094, -0.006	-	-							
Prairie Dawn	7/20/91	08:19:27	08:22:28	-	-	-	-	-0.02, -0.020							
Prosperity		11:39:19	11:40:55	-	-	-	-	**							
Clyde Butcher		11:55:54	11:56:27	-	-	-	-	-							
Lil Charley		13:31:19	13:31:38	-	-	-	-	-							
C.W. Rushing		16:56:41	16:59:16	*	0.099, 0.001	0.186, -0.001	-	-0.007, 0.041							
Conti-Nan		16:56:41	16:59:16	0.331, 0.021	0.297, 0.025	0.256, 0.011	*	*							
Cooperative Vanguard	7/21/91	13:08:36	13:11:50	0.338, 0.016	0.274, 0.006	0.303, 0.010	**	**							
Conti-Karla		14:57:38	14:59:13	0.188, -0.016	0.140, **	0.168, 0.025	**	-0.028, -0.034							
Cooperative Mariner	7/22/91	10:34:47	10:36:47	**	**	**	**	0.020, -0.000							
Hornet		12:11:57	12:13:47	0.181, 0.025	**	0.165, 0.024	-0.034, -0.011	**							
Cooperative Ambassador		13:16:41	13:18:43	0.318, 0.035	0.283, -0.030	0.312, 0.016	-0.046, 0.020	**							
Eastern		13:20:30	13:23:42	**	**	**	**	0.161, 0.041							
Sam M. Fleming		13:24:11	13:25:52	0.319, 0.044	0.311, 0.041	0.322, -0.025	0.108, 0.002	0.211, **							
Kevin Michael		14:00:12	14:02:12	0.203, 0.028	0.146, -0.005	0.170, 0.026	*	*							
A.M. Thompson	7/23/91	14:12:24	14:14:23	**	0.130, 0.021	0.140, -0.011	*	**							
Lil Charley		14:20:30	14:20:55	0.311, **	0.265, -0.019	0.289, 0.031	*	*							
Badger		15:55:55	15:57:30	0.203, -0.006	0.136, -0.015	0.171, -0.020	*	0.221, 0.004							
Kay D		15:59:29	16:00:13	0.226, 0.036	0.141, 0.012	0.188, -0.005	*	0.011, -0.017							
Evey-T		16:24:21	16:26:55	0.308, 0.002	**	0.293, 0.031	*	*							
G.R. Packet	7/24/91	8:25:25	8:28:39	0.591, -0.200	0.303, 0.002	0.270, 0.021	0.106, -0.031	**							
Mary L.		9:14:50	9:17:21	**	**	**	**	0.220, -0.010							
Dud Hollinger		9:58:51	10:02:05	**	**	**	**	**							
C.W. Rushing		12:13:19	12:13:57	**	**	**	**	**							
Dell Butcher		13:44:39	13:46:27	0.312, -0.157	0.169, -0.025	**	**	**							
Coral Dawn		14:48:44	14:51:19	0.524, -0.200	0.291, **	**	0.073, -0.023	**							
Teresa R. Beesacker		15:43:33	15:45:33	**	**	0.282, 0.021	**	**							

Goose Island Site, Trip 2 (Continued)

Tow name	Date	Passing Time		Induced velocity m/s									
		Beginning	Ending	MMB511/1000	MMB527/642	MMB527/332	S4/071	S4/151					
Ardyce Randall	7/18/91	10:42:18	10:44:10	U _{im} 0.000, -0.021	U _{im} 0.347, -0.040	U _{im} 0.363, -0.045	U _{im} -	U _{im} V _{im} -0.184, -0.021					
Scarlet Knight		12:26:59	12:28:46	-0.021, **	0.348, -0.034	0.367, -0.020	-	-					
James F. Neal		14:17:04	14:18:34	-0.027, **	0.319, -0.025	0.302, **	0.501, -0.028	**					
Helen M. Clements		17:23:03	17:25:22	0.074, -0.006	0.642, 0.040	0.665, -0.045	-	*					
Elizabeth Ann		18:00:59	18:02:46	-	**	**	-	-					
Frank T. Heffelfinger	7/19/91	11:03:32	11:05:24	-0.021, 0.025	0.292, -0.041	0.517, -0.051	-	-					
Queen City		14:33:45	14:35:21	-0.019, **	0.290, 0.012	0.421, -0.065	*	-					
Helen M. Clements		16:24:27	16:26:12	**	0.239, -0.036	**	0.462, -0.032	-					
Frank T. Heffelfinger		16:33:21	16:36:52	0.130, -0.049	0.553, 0.010	0.793, 0.000	0.745, 0.495	-					
Cooperative Venture		18:05:37	18:56:45	0.102, -0.026	-	-	-	-					
Volunteer State		08:09:31	08:11:39	-	-	-	-	-					
Prairie Dawn	7/20/91	08:19:27	08:22:28	-0.040, **	-	-	-	0.419, 0.001					
Prosperity		11:39:19	11:40:55	0.082, -0.019	0.569, -0.014	**	-	0.846, 0.238					
Clyde Butcher		11:55:54	11:56:27	-	0.279, -0.050	**	-	0.541, 0.192					
Lil Charley		13:31:19	13:31:38	-	**	0.422, -0.066	-	0.552, 0.091					
C. W. Rushing		16:56:41	16:59:16	-0.019, 0.029	0.292, -0.051	**	-	**					
Conti-Nan		16:56:41	16:59:16	0.078, -0.030	0.580, 0.001	0.589, -0.009	-	0.837, 0.271					
Cooperative Vanguard	7/21/91	13:08:36	13:11:50	**	**	**	0.631, 0.046	**					
Conti-Karla		14:57:38	14:59:13	*	0.228, **	0.401, -0.040	0.331, -0.033	**					
Cooperative Mariner	7/22/91	10:34:47	10:36:47	0.022, 0.021	0.283, -0.051	**	-	**					
Hornet		12:11:57	12:13:47	0.010, -0.056	0.313, **	0.316, -0.065	0.396, **	0.429, -0.015					
Cooperative Ambassador		13:16:41	13:18:43	0.169, -0.046	**	0.587, **	0.597, 0.037	**					
Eastern		13:20:30	13:23:42	**	0.501, 0.081	0.572, **	**	0.690, **					
Sam M. Fleming		13:24:11	13:25:52	0.213, **	0.587, 0.046	0.659, 0.090	0.671, 0.066	0.820, 0.230					
Kevin Michael		14:00:12	14:02:12	*	0.291, -0.040	0.291, **	0.398, 0.001	0.450, -0.002					
A.M. Thompson	7/23/91	14:12:24	14:14:23	**	0.296, **	**	0.410, 0.090	**					
Lil Charley		14:20:30	14:20:55	0.209, -0.050	0.559, 0.003	0.618, -0.011	0.631, 0.095	0.764, 0.228					
Badger		15:55:55	15:57:30	0.001, -0.033	0.342, -0.056	0.320, 0.015	0.388, 0.101	0.355, 0.019					
Kay D		15:59:29	16:00:13	**	**	**	**	**					
Evey-T		16:24:21	16:26:55	*	0.562, 0.012	**	**	**					
G.R. Packet	7/24/91	8:25:25	8:28:39	**	**	**	-	0.792, -0.051					
Mary L.		9:14:50	9:17:21	**	**	**	-	0.699, 0.154					
Dud Hollinger		9:58:51	10:02:05	0.189, -0.050	*	**	**	**					
C. W. Rushing		12:13:19	12:13:57	**	**	**	0.552, 0.071	**					
Dell Butcher		13:44:39	13:46:27	**	0.191, -0.010	0.107, -0.019	0.420, 0.101	**					
Coral Dawn		14:48:44	14:51:19	*	0.386, -0.006	**	**	**					
Teresa R. Beesecker		15:43:33	15:45:33	**	**	**	0.635, 0.090	**					

Goose Island Site, Trip 2 (Concluded)

Tow name	Date	Passing Time		Induced velocity m/s					
		Beginning	Ending	S4/040		S4/832		S4/834	
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
Ardyce Randall	7/18/91	10:42:18	10:44:10	-	-	-	-	0.508, 0.093	-
Scarlet Knight		12:26:59	12:28:46	-	-	-	-	-	-
James F. Neal		14:17:04	14:18:34	0.435, -0.008	-	-0.037, -0.043	-	0.259, 0.400	-
Helen M. Clements		17:23:03	17:25:22	**	-	-	-	**	-
Elizabeth Ann		18:00:59	18:02:46	-	-	-	-	-	-
Frank T. Heffelfinger	7/19/91	11:03:32	11:05:24	-	-	-	-	**	-
Queen City		14:33:45	14:35:21	-	-	-	-	0.440, -0.059	-
Helen M. Clements		16:24:27	16:26:12	-	-	-	-	0.512, -0.068	-
Frank T. Heffelfinger		16:33:21	16:36:52	-	-	-	-	0.899, 0.139	-
Cooperative Venture		18:05:37	18:56:45	-	-	-	-	0.857, 0.055	-
Volunteer State		08:09:31	08:11:39	-	-	-	-	-	-
Prairie Dawn	7/20/91	08:19:27	08:22:28	-	-	-	-	**	-
Prosperity		11:39:19	11:40:55	-	-	-	-	0.809, 0.103	-
Clyde Butcher		11:55:54	11:56:27	-	-	0.470, -0.039	-	0.573, 0.056	-
Lil Charley		13:31:19	13:31:38	-	-	**	-	**	-
C.W. Rushing		16:56:41	16:59:16	-	-	**	-	0.558, 0.040	-
Conti-Nan		16:56:41	16:59:16	-	-	0.900, 0.139	-	0.849, 0.100	-
Cooperative Vanguard	7/21/91	13:08:36	13:11:50	0.912, 0.318	-	**	-	0.797, 0.102	-
Conti-Karla		14:57:38	14:59:13	0.393, 0.000	-	0.391, 0.103	-	0.481, -0.060	-
Cooperative Mariner	7/22/91	10:34:47	10:36:47	0.436, 0.080	-	**	-	0.440, 0.102	-
Hornet		12:11:57	12:13:47	0.450, 0.261	-	**	-	0.449, 0.102	-
Cooperative Ambassador		13:16:41	13:18:43	0.779, 0.219	-	0.808, 0.142	-	0.726, **	-
Eastern		13:20:30	13:23:42	**	-	0.771, 0.089	-	**	-
Sam M. Fleming		13:24:11	13:25:52	0.790, 0.169	-	0.838, 0.110	-	0.818, 0.109	-
Kevin Michael		14:00:12	14:02:12	**	-	**	-	**	-
A.M. Thompson	7/23/91	14:12:24	14:14:23	**	-	**	-	0.501, 0.081	-
Lil Charley		14:20:30	14:20:55	**	-	**	-	0.791, 0.091	-
Badger		15:55:55	15:57:30	0.468, 0.011	-	0.411, 0.009	-	0.470, -0.035	-
Kay D		15:59:29	16:00:13	0.514, 0.129	-	**	-	0.541, 0.002	-
Evey-T		16:24:21	16:26:55	0.882, 0.160	-	**	-	0.702, 0.056	-
G.R. Packet	7/24/91	8:25:25	8:28:39	**	-	0.803, 0.062	-	0.740, 0.068	-
Mary L.		9:14:50	9:17:21	0.682, 0.136	-	**	-	-	-
Dud Hollinger		9:58:51	10:02:05	0.718, 0.030	-	0.747, **	-	-	-
C.W. Rushing		12:13:19	12:13:57	0.711, 0.269	-	**	-	-	-
Dell Butcher		13:44:39	13:46:27	**	-	**	-	-	-
Coral Dawn		14:48:44	14:51:19	0.760, 0.112	-	**	-	-	-
Teresa R. Beescker		15:43:33	15:45:33	**	-	**	-	-	-

Clarks Ferry Site, Trip 1

Tow name	Date	Passing time		Induced velocity m/s											
		Beginning	Ending	MMBS11/1001	MMBS11/1130	MMBS11/1131	MMBS11/998	MMBS11/999							
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
C.W. Rushing 1	5/16/91	12:07:44	12:08:56	*	**	**	**	0.646, 0.046	*						*
Donnie Ray Jr. 1		12:22:50	12:24:30	*	0.250, -0.031	0.280, -0.037		0.261, 0.042	*						*
Samantha		13:26:43	13:27:06	*	0.136, -0.016	**	**	**	**						**
C.W. Rushing 2	5/17/91	12:26:16	12:26:36	0.027, -0.001	**	**	**	**						0.248, -0.015	
Jemco Towing		15:03:40	15:04:39	0.180, 0.029	0.291, 0.022	0.312, 0.013	0.387, -0.002	0.401, -0.006							
T.S. Kunsman		16:31:55	16:33:22	*	0.130, -0.009	0.178, -0.006	0.183, -0.037	0.224, -0.031							
Dell Butcher 1		17:43:27	17:46:12	0.206, 0.039	0.276, N/A	0.331, N/A	0.398, -0.017	0.431, 0.045							
Pearl B.	5/19/91	10:06:30	10:07:53	-	-	-	-	-	-						-
Conti-Afton		11:41:08	11:42:35	-	-	-	-	-	-						-
Jack D. Wofford		16:33:57	16:35:16	**	**	**	**	**	**						**
Donnie Ray Jr. 2	5/20/91	11:33:41	11:36:31	**	**	**	**	**	**						**
Sunflower 1		12:24:22	12:24:37	**	0.159, -0.011	**	**	**	**					0.251, -0.037	**
American Beauty 1		15:48:23	15:50:13	**	**	**	**	**	**					**	**
Sierra Dawn	5/21/91	09:09:28	09:11:00	**	**	**	**	**	**					**	**
Cooperative Vanguard		09:36:54	09:37:56	**	**	**	**	**	**					**	**
Cindy J. Erickson		10:29:26	10:31:47	**	**	**	**	**	**					0.368, 0.005	**
Frank H. Peavy		10:49:16	10:50:37	**	**	**	**	**	**					**	**
Helen M. Clements		11:32:51	11:34:43	0.202, 0.018	0.318, 0.036	0.348, 0.036	0.140, -0.031	0.426, 0.039							
Sunflower 2		12:13:06	12:13:22	**	**	**	**	**	**					**	**
Dell Butcher 2		12:37:20	12:38:44	**	**	**	**	**	**					0.242, -0.034	**
Hornet		13:30:54	13:32:27	**	**	**	**	**	**					**	**
Volunteer State		16:08:16	16:09:56	**	**	**	**	**	**					**	**
Edward J. Hancock	5/22/91	09:52:51	09:55:33	*	0.278, 0.031	**	*	**	**					**	**
Starfire		10:54:32	10:56:51	0.178, 0.016	**	**	*	0.386, 0.009	*						
American Beauty 2		13:46:39	13:47:10	**	**	**	**	0.258, -0.027	**						

- Meter was not available
 * Meter did not work
 ** No obvious impact

Clarks Ferry Site, Trip 1 (Continued)

Tow name	Date	Passing time		Induced velocity m/s					
		Beginning	Ending	MMB511/1000		MMB527/332		MMB527/642	
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
C.W. Rushing 1	5/16/91	12:07:44	12:08:56	0.824, 0.008	**	**	**	*	*
Donnie Ray Jr. 1		12:22:50	12:24:30	0.469, 0.044	**	**	0.493, -0.064	*	*
Samantha		13:26:43	13:27:06	**	0.453, -0.052	**	**	*	*
C.W. Rushing 2	5/17/91	12:26:16	12:26:36	**	**	0.341, -0.050	*	*	*
Jemco Towing		15:03:40	15:04:39	0.444, 0.001	**	**	**	**	**
T.S. Kunsman		16:31:55	16:33:22	0.271, -0.028	**	**	0.549, -0.027	*	*
Dell Butcher 1		17:43:27	17:46:12	0.449, 0.020	*	*	*	0.441, -0.085	**
Pearl B.	5/19/91	10:06:30	10:07:53	-	**	**	**	**	**
Conti-Aflon		11:41:08	11:42:35	-	**	**	**	**	**
Jack D. Wofford		16:33:57	16:35:16	**	**	**	**	0.132, -0.059	**
Donnie Ray Jr. 2	5/20/91	11:33:41	11:36:31	**	**	0.581, 0.058	**	*	*
Sunflower 1		12:24:22	12:24:37	**	**	**	**	*	*
American Beauty 1		15:48:23	15:50:13	**	**	**	**	*	0.434, 0.198
Sierra Dawn	5/21/91	09:09:28	09:11:00	**	**	-	-	*	*
Cooperative Vanguard		09:36:54	09:37:56	**	**	-	-	-	*
Cindy J. Erickson		10:29:26	10:31:47	0.399, 0.014	**	-	-	-	*
Frank H. Peavy		10:49:16	10:50:37	**	**	-	-	-	*
Helen M. Clements		11:32:51	11:34:43	0.439, 0.059	**	-	-	-	-
Sunflower 2		12:13:06	12:13:22	**	**	-	-	-	-
Dell Butcher 2		12:37:20	12:38:44	0.291, -0.034	**	-	-	-	-
Hornet		13:30:54	13:32:27	**	**	-	-	-	-
Volunteer State		16:08:16	16:09:56	0.406, -0.004	**	-	-	-	0.721, 0.077
Edward J. Hancock	5/22/91	09:52:51	09:55:33	**	**	-	-	-	0.737, 0.098
Starfire		10:54:32	10:56:51	**	**	-	-	-	0.799, 0.113
American Beauty 2		13:46:39	13:47:10	**	**	-	-	-	**

- Meter was not available

* Meter did not work

** No obvious impact

Clarks Ferry Site, Trip 1 (Concluded)

Tow name	Date	Passing time		Induced velocity m/s					
		Beginning	Ending	S4/040		S4/832		S4/071	
				U _{im}	V _{im}	U _{im}	V _{im}	U _{im}	V _{im}
C.W. Rushing 1	5/16/91	12:07:44	12:08:56	-			**	-	
Donnie Ray Jr. 1		12:22:50	12:24:30	-			**	-	
Samantha		13:26:43	13:27:06	-			0.434,-0.042	-	
C.W. Rushing 2	5/17/91	12:26:16	12:26:36	*			**	**	
Jemco Towing		15:03:40	15:04:39	*			**	**	
T.S. Kunsman		16:31:55	16:33:22	*			*	0.346,-0.084	
Dell Butcher 1		17:43:27	17:46:12	*			0.314, 0.065	0.819, 0.151	
Pearl B.	5/19/91	10:06:30	10:07:53	*			0.091,-0.085	-	
Conti-Afton		11:41:08	11:42:35	*			0.107,-0.043	0.433, 0.010	
Jack D. Wofford		16:33:57	16:35:16	**			0.192, 0.001	0.414,-0.041	
Donnie Ray Jr. 2	5/20/91	11:33:41	11:36:31	0.887, 0.121			*	*	
Sunflower 1		12:24:22	12:24:37	**			*	*	
American Beauty 1		15:48:23	15:50:13	0.801, 0.081			**	*	
Sierra Dawn	5/21/91	09:09:28	09:11:00	**			**	*	
Cooperative Vanguard		09:36:54	09:37:56	0.484,-0.017			*	-	
Cindy J. Erickson		10:29:26	10:31:47	**			0.385, 0.088	-	
Frank H. Peavy		10:49:16	10:50:37	**			*	-	
Helen M. Clements		11:32:51	11:34:43	0.758, 0.059			*	-	
Sunflower 2		12:13:06	12:13:22	**			*	-	
Dell Butcher 2		12:37:20	12:38:44	0.474,-0.008			*	-	
Hornet		13:30:54	13:32:27	0.718, 0.044			*	-	
Volunteer State		16:08:16	16:09:56	0.749, 0.067			*	**	
Edward J. Hancock	5/22/91	09:52:51	09:55:33	0.708, 0.064			0.349, 0.009	**	
Starfire		10:54:32	10:56:51	**			*	**	
American Beauty 2		13:46:39	13:47:10	0.431,-0.064			**	**	

- Meter was not available

* Meter did not work

** No obvious impact

Clarks Ferry Site, Trip 2

Tow name	Date	Passing time		Induced velocity m/s											
		Beginning	Ending	MMBS11/1001		MMBS11/998		MMBS11/999		MMBS11/1000		MMBS11/1130			
				U _{im}	V _{im}	U _{im}	V _{im}	U _{im}	V _{im}	U _{im}	V _{im}	U _{im}	V _{im}		
C. W. Rushing Evey-T Sunflower 1 Evelyn C. Sunflower 2 Conti-Nan 1 Night 1 Night 2 Night 3	10/17/91	07:33:54	07:34:17	**		0.062, -0.025		0.084, -0.022		0.104, -0.016		0.072, 0.000			
		08:43:43	08:45:34	0.095, 0.005		0.145, 0.002		0.171, -0.004		0.170, 0.011		0.182, 0.020			
		11:43:54	11:44:12	0.030, -0.011		0.064, -0.009		0.089, -0.014		0.118, -0.009		0.061, 0.001			
		11:45:01	11:45:36	0.033, -0.026		0.058, -0.011		0.095, -0.017	**			0.074, 0.008			
		17:06:09	17:06:35	0.070, N/A		0.121, 0.015		0.148, 0.015		0.158, 0.014		0.167, 0.016			
		18:54:59	18:57:14	0.011, N/A		0.034, -0.008		0.044, -0.005		0.064, -0.007		0.054, -0.019			
		20:14:14	20:14:33	0.074, N/A		0.106, 0.013		0.125, 0.013	**	**		0.150, 0.007	**		
		20:19:50	20:20:12	0.077, N/A		**	**	**	**	**					
		20:50:43	20:51:25	0.036, N/A		**	**	**	**	0.097, 0.002		0.089, -0.016			
Lady Lone Star 1 Lady Lone Star 2 Kevin Michael Deborah Valentine Volunteer State Sunflower 3 Frank Stegbauer	10/18/91	07:16:51	07:17:25	0.029, N/A		0.060, -0.001		0.091, -0.002	**	**		0.079, -0.014	**		
		07:43:37	07:43:44	0.063, N/A		**	**	**	**	**				**	
		08:24:59	08:27:08	0.018, N/A		0.029, -0.006		0.061, -0.011		0.070, -0.009		0.053, -0.019			
		09:55:28	09:58:08	0.011, N/A		0.030, -0.012		0.046, -0.006		0.069, 0.000		0.060, -0.015			
		10:06:34	10:07:14	-0.035, N/A		0.008, -0.011		0.026, -0.016		0.019, -0.011		0.043, -0.006			
		11:26:47	11:27:04	**		**	**	0.076, -0.002	**	**		**	**		
Kathy Ellen Jack Bullard Marc Conti-Nan 2 Cristina Ecstein Coast Guard 65504 Prairie Dawn	10/19/91	12:32:08	12:32:52	-0.002, N/A		0.028, -0.016		0.059, -0.004		0.065, 0.006		0.055, -0.019			
		10:13:44	10:16:43	0.009, N/A		0.035, N/A		0.041, -0.005		0.075, -0.000		0.066, -0.014			
		12:07:14	12:09:42	0.169, 0.003		0.201, 0.016		0.208, N/A		0.228, N/A		0.228, 0.005			
		12:57:38	12:58:29	0.039, -0.012		0.040, -0.006		0.074, -0.016		0.083, -0.001	**	**			
		13:44:23	13:45:17	0.104, 0.001		0.131, 0.014		0.141, 0.009		0.151, 0.015		0.169, 0.007			
		14:03:17	14:04:18	0.094, -0.001		**	**	0.139, 0.010	**	0.140, 0.011		0.148, 0.006	**		
		14:54:46	14:54:57	0.055, -0.011		0.079, -0.001		**	**	0.101, 0.000		**	**		
		17:30:03	17:31:27	0.118, 0.011		0.151, 0.016		0.166, 0.014		0.183, 0.016		0.191, 0.010			
		Noname	10/20/91	06:54:14	06:55:25	*		0.146, 0.014		0.164, N/A		0.169, 0.019	*		
Cooperative		07:05:14	07:07:29	0.002, -0.007		0.041, N/A		0.055, -0.010		0.076, -0.004		0.066, -0.012			
Ambassador															
Yazoo City		09:31:48	09:34:30	0.121, 0.015		0.146, 0.016		0.174, 0.026		0.183, N/A		0.191, 0.006			
Georree W. Banta		12:19:36	12:21:59	0.099, 0.011		0.139, 0.014		0.154, N/A		0.161 N/A		0.154, 0.006			

- Meter was not available

* Meter did not work

** No obvious impact

Clarks Ferry Site, Trip 2 (Continued)

Tow name	Date	Passing time		Induced velocity m/s							
		Beginning	Ending	MMB511/1131		MMB527/332		MMB527/642		S4/834	
				U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}	U_{im}	V_{im}
C.W. Rushing	10/17/91	07:33:54	07:34:17	0.092, 0.002		0.143, -0.036		0.144, -0.024		-	
Evey-T		08:43:43	08:45:34	0.208, 0.016		0.348, 0.025		0.336, 0.011		-	
Sunflower 1		11:43:54	11:44:12	0.096, 0.004		0.162, -0.011		**		*	
Evelyn C.		11:45:01	11:45:36	0.098, 0.003		0.161, 0.009		0.178, -0.021		*	
Sunflower 2		17:06:09	17:06:35	0.178, 0.005		0.318, 0.014		0.341, 0.022		*	
Conti-Nan 1		18:54:59	18:57:14	0.069, -0.025		0.112, -0.026		0.089, -0.051		0.241, -0.002	
Night 1		20:14:14	20:14:33	0.159, -0.001		0.284, 0.016		0.278, 0.011		*	
Night 2		20:19:50	20:20:12	**		**		0.274, 0.020		*	
Night 3		20:50:43	20:51:25	0.111, -0.012		**		0.178, -0.072		*	
Lady Lone Star 1	10/18/91	07:16:51	07:17:25	0.105, -0.015		**		**		0.258, -0.024	
Lady Lone Star 2		07:43:37	07:43:44	**		0.292, 0.014		**		*	
Kevin Michael		08:24:59	08:27:08	0.059, -0.020		0.099, -0.029		0.123, -0.034		0.257, -0.055	
Deborah Valentine		09:55:28	09:58:08	0.074, -0.011		0.108, -0.027		0.093, -0.049		**	
Volunteer State		10:06:34	10:07:14	0.059, -0.010		0.032, -0.015		0.080, -0.016		0.207, -0.071	
Sunflower 3		11:26:47	11:27:04	**		0.168, -0.020		0.191, -0.021		**	
Frank Stegbauer		12:32:08	12:32:52	0.081, -0.014		0.128, -0.042		0.100, -0.020		*	
Kathy Ellen	10/19/91	10:13:44	10:16:43	0.076, -0.015		0.107, -0.031		0.163, -0.044		0.238, -0.068	
Jack Bullard		12:07:14	12:09:42	0.238, 0.001		0.415, 0.016		0.483, 0.001		0.662, N/A	
Marc		12:57:38	12:58:29	0.097, -0.016		**		0.126, -0.025		0.318, -0.025	
Conti-Nan 2		13:44:23	13:45:17	0.174, 0.005		0.347, 0.021		0.324, 0.010		0.540, 0.088	
Cristina Ecstein		14:03:17	14:04:18	0.166, 0.003		0.321, 0.031		0.321, 0.006		0.470, 0.032	
Coast Guard 65504		14:54:46	14:54:57	**		0.173, -0.035		**		**	
Prairie Dawn		17:30:03	17:31:27	0.202, 0.004		0.350, 0.043		0.363, 0.020		*	
Noname	10/20/91	06:54:14	06:55:25	*		0.357, 0.032		*		0.542, 0.016	
Cooperative		07:05:14	07:07:29	0.079, -0.014		0.123, 0.026		*		0.261, -0.049	
Ambassador											
Yazoo City		09:31:48	09:34:30	0.203, -0.001		0.380, 0.030		0.381, 0.015		*	
George W. Banta		12:19:36	12:21:59	0.176, 0.009		0.330, 0.016		0.329, 0.025		0.660, -0.068	

- Meter was not available

* Meter did not work

** No obvious impact

Clarks Ferry Site, Trip 2 (Concluded)

Tow name	Date	Passing time		Induced velocity m/s					
		Beginning	Ending	S4/151		S4/832		S4/040	
				U _{im}	V _{im}	U _{im}	V _{im}	U _{im}	V _{im}
C.W. Rushing	10/17/91	07:33:54	07:34:17	-	-	-	-	*	-
Evey-T		08:43:43	08:45:34	-	-	-	-	*	-
Sunflower 1		11:43:54	11:44:12	**		0.154, -0.011		*	*
Evelyn C.		11:45:01	11:45:36	0.223, 0.012		**		*	*
Sunflower 2		17:06:09	17:06:35	0.399, 0.107		0.371, 0.030		-	-
Conti-Nan 1		18:54:59	18:57:14	0.163, 0.206		0.123, 0.069		0.071, -0.036	
Night 1		20:14:14	20:14:33	0.390, 0.098		0.327, 0.037		0.283, 0.010	
Night 2		20:19:50	20:20:12	0.374, 0.088		0.350, 0.034		*	*
Night 3		20:50:43	20:51:25	**		**		0.047, 0.020	
Lady Lone Star 1	10/18/91	07:16:51	07:17:25	**		**		*	*
Lady Lone Star 2		07:43:37	07:43:44	**		**		*	*
Kevin Michael		08:24:59	08:27:08	0.161, 0.196		0.101, 0.053		*	*
Deborah Valentine		09:55:28	09:58:08	0.184, 0.153		0.146, 0.057		*	*
Volunteer State		10:06:34	10:07:14	0.032, 0.181		0.061, 0.089		*	*
Sunflower 3		11:26:47	11:27:04	-		-		*	*
Frank Stegbauer		12:32:08	12:32:52	0.202, -0.066		0.143, -0.044		*	*
Kathy Ellen	10/19/91	10:13:44	10:16:43	0.212, 0.158		0.171, 0.059		*	*
Jack Bullard		12:07:14	12:09:42	0.626, 0.272		*		0.488, 0.075	
Marc		12:57:38	12:58:29	0.208, 0.105		0.188, 0.031		*	*
Conti-Nan 2		13:44:23	13:45:17	0.432, 0.131		0.370, 0.045		*	*
Cristina Ecstein		14:03:17	14:04:18	0.359, 0.106		0.348, 0.050		*	*
Coast Guard 65504		14:54:46	14:54:57	**		0.196, -0.190		**	**
Prairie Dawn		17:30:03	17:31:27	0.446, 0.129		0.373, 0.046		0.252, 0.046	
Noname	10/20/91	06:54:14	06:55:25	0.398, 0.107		0.372, 0.056		*	*
Cooperative		07:05:14	07:07:29	0.158, 0.150		0.189, 0.061		*	*
Ambassador		09:31:48	09:34:30	0.477, 0.147		0.404, 0.069		*	*
Yazoo City		12:19:36	12:21:59	0.623, 0.272		**		*	*
George W. Banta									

- Meter was not available

* Meter did not work

** No obvious impact

APPENDIX XII.

**MAXIMUM WAVE HEIGHT AND DRAWDOWN
AT ALL STUDY SITES AND FOR ALL BARGE-TOW EVENTS**

McEver's Island Site

<i>Name</i>	<i>Date</i>	<i>Maximum* wave height (m)</i>	<i>Maximum* drawdown (m)</i>
R. W. Naye	5/16/89	0.03	-0.213
Evelyn C.			-0.091
Mary Ellen	5/17/89		-0.073
Elaine Jones		0.03	-0.17
Bill McCormick			-0.11
Nicolas Duncan		0.05	-0.05
Mobil Leader	5/18/89	0.07	-0.18
Reliance		0.14	-0.152
Cooperative Vanguard		0.15	-0.17
Marvin E. Norman		0.05	-0.082
Illini		0.06	-0.076
Thurston B. Morton	5/19/89	0.02	
Clarence G. Frame		0.01	-0.24

* taken from a staff gage reading

Kampsville Site, Trip 1

<i>Name</i>	<i>Date</i>	<i>Maximum wave height (m)</i>	<i>Maximum drawdown (m)</i>
Mallard	10/11/90	0.09*	-0.15*
Nicholas Duncan		0.04*	-0.03*
Bill Gee		0.3*	-0.122*
Mr. Aldo	10/12/90	0.061	-0.09
Floyd H. Blaske		0.092	-0.075
Marvin E. Norman	10/13/90	0.061	-0.029
Luke Burton		0.244	-0.107
Sugarland		0.092	-0.123
William C Norman		0.122	-0.09
Frank H. Peavey		0.13	-0.014
Conti Karla		0.107	-0.105
Margaret O.			-0.183*
Mr. Paul	10/14/90	0.06	-0.075
Rambler		0.076	-0.06
Mr. Lawrence		0.168	-0.121
Mallard		0.137	-0.06
Charles Lehman		0.106	-0.106
Nicholas Duncan		0.214	-0.09
Jeff Boat		0.061	-0.093
Mary Ann		0.091	-0.03
Ardyce Randall	10/15/90	0.061	-0.032
Mr. Paul		0.077	-0.077
Exxon St. Louis		0.077	-0.105
Margaret O.		0.107	-0.153
Mr. Lawrence		0.12*	-0.183*
A. L. Smith	10/16/90	0.122	-0.062
Ste. Genevieve		0.107	-0.063
Nicole Brent	10/17/90	0.229	-0.123
Frank H. Peavey		0.153	-0.108

*taken from a staff gage reading

Kampsville Site, Trip 2

<i>Name</i>	<i>Date</i>	<i>Maximum wave height (m)</i>	<i>Maximum drawdown (m)</i>
Ranger	08/13/91	0.01*	-0.012*
Dixie Patriot		0.153	-0.167
Orleanian		0.213	-0.077
Pat Breen		0.076	-0.105
Dixie Express II		0.091	-0.105
Jo Anne Stegbauer		0.122	-0.063
Ste. Genevieve		0.061	-0.062
Bob White		0.061	-0.078
Night 14-01	08/14/91	0.092	-0.062
Night 14-02		0.092	-0.062
Irving Crown		0.092	-0.047
Gordon Jones		0.167	-0.154
George W. Shamblin		0.122	-0.031
Katherine L.		0.198	-0.045
Thruston B. Morton		0.08	-0.062
Julie White		0.045	-0.078
Ranger		0.13*	-0.01*
Illini		0.076	-0.047
Bronwynne Brent		0.076	-0.048
Sugarland		0.031	-0.062
Frank Stegbauer		0.168	-0.093
Bill McCormick	08/15/91		
Marvin E. Norman		0.06*	-0.061*
Olmstead		0.076	-0.079
Jack D. Wofford		0.061	-0.094
Dixie Express		0.122	-0.094
Hal D. Miller		0.061	-0.124
Jesse Brent		0.107	-0.093

*taken from a staff gage reading

Apple River Island Site

<i>Name</i>	<i>Date</i>	<i>Maximum wave height (m)</i>	<i>Maximum drawdown (m)</i>
Yazoo	5/18/90	0.03*	-0.015*
Cooperative Ambassador		0.03*	-0.076*
Christine Bailey		0.04*	-0.067*
Kathy Ellen			
W.A. Kernan	5/19/90		
Hornet		0.05*	-0.05*
Conti Bonnie		0.09*	-0.06*
Becky Lynn		0.09*	-0.10*
Lexington			-0.046*
Philip M. Pfeffer	5/20/90		
Merlin Banta			
Rusty Flowers		0.122	-0.077
Tom Talbert		0.29	-0.095
Herman Pott			-0.106*
Walter Brunson	5/21/90	0.122	-0.073
Dell Butcher		0.107	-0.058
Mary Gail		0.092	-0.031
T. S. Kunsman		0.168	-0.104
D. Ray Miller		0.092	-0.088
Mary Gail	5/22/90	0.077	-0.042
Trojan		0.107	-0.045
Melinda Brent		0.092	-0.015
Cooperative Mariner		0.259	-0.095
Ed Renshaw		0.16*	-0.122*
Kevin Michael	5/23/90	0.11*	-0.03*
Jack D. Wofford		0.121	-0.046
Trojan		0.121	-0.031

*taken from a staff gage reading

Goose Island Site, Trip 1

<i>Name</i>	<i>Date</i>	<i>Maximum wave height (m)</i>	<i>Maximum drawdown (m)</i>
Sierra Dawn	8/24/90		
Dell Butcher		0.122	-0.061
William C. Norman		0.122	-0.046
Normania		0.107	-0.046
Dave Carleton			
Hugh C. Blaske	8/25/90	0.092	-0.063
Teresa Renee Beesecker		0.122	-0.094
Trojan Warrior		0.122	-0.063
Hoosier State		0.12	-0.046
Reliance	8/26/90		
Kevin Michael		0.106	-0.063
Sumac		0.655	-0.031
Twin Cities		0.167	-0.094
Cooperative Vanguard			
Superior	8/27/90	0.106	-0.015
Helen M. Clements			
Greenville			

Goose Island Site, Trip 2

<i>Name</i>	<i>Date</i>	<i>Maximum wave height (m)</i>	<i>Maximum drawdown (m)</i>
Ardyce Randall	7/18/91	0.02	-0.032
Scarlet Knight		0.107	-0.032
James F. Neal		0.077	-0.032
Helen M. Clements		0.077	-0.031
Elizabeth Ann		0.046	-0.04
Frank T. Heffelfinger	7/19/91	0.046	-0.031
Queen City		0.091	-0.046
Helen M. Clements		0.046	-0.033
Frank T. Heffelfinger		0.061	-0.048
Cooperative Venture			-0.03
Volunteer State	7/20/91	0.106	-0.094
Night19-01		0.031	-0.064
Night19-02		0.031	-0.048
Night20-01			-0.03
Night20-02		0.122	-0.063
G. R. Packet		0.077	-0.048
Prairie Dawn		0.046	-0.024
Prosperity		0.077	-0.024
Clyde Butcher		0.046	-0.063
Lil Charley		0.091	-0.063
C. W. Rushing		0.22	
Conti Nan		0.138	-0.063
Mary L			-0.046
Cooperative Vanguard		0.077	-0.024
Conti Karla		0.091	-0.048
Cooperative Mariner	7/22/91	0.107	-0.063
Hornet		0.076	-0.078
Coperative Ambassador		0.037	-0.063
Eastern			-0.14
Sam M. Fleming		0.061	-0.11
Kevin Michael	7/23/91	0.092	-0.063
A. M. Thompson		0.046	-0.063
Susan Elizabeth			
Lil Charley		0.122	-0.046
Badger		0.122	-0.079
Kay D		0.091	-0.045
Evey T		0.061	-0.034
Robert Ingle		0.061	-0.018

Goose Island Site, Trip 2 (Concluded)

<i>Name</i>	<i>Date</i>	<i>Maximum wave height (m)</i>	<i>Maximum drawdown (m)</i>
Prairie Dawn		0.046	-0.012
G. R. Packet & Pioneer	7/24/91	0.107	-0.046
Mary L		0.077	-0.047
Dub Hollinger		0.046	-0.012
C. W. Rushing		0.092	-0.032
Dell Butcher		0.061	-0.048
Coral Dawn		0.046	-0.033
Teresa R. Beesecker		0.061	-0.03
Sir-Ene		0.03	-0.03
Rusty Flowers		0.061	-0.03

Clarks Ferry Site, Trip 1

<i>Name</i>	<i>Date</i>	<i>Maximum wave height (m)</i>	<i>Maximum drawdown (m)</i>
C.W. Rushing (1)	5/16/91	0.061	-0.03
Donnie Ray Jr. (1)			
Samantha		0.214	-0.015
C.W. Rushing (2)	5/17/91		
Jemco Towing			
T.S. Kunsmann			
Ell Butcher (1)			
Lady Lone Star	5/18/91	0.137	-0.075
Pearl B.	5/19/91	0.092	-0.06
Conti-Afton		0.061*	-0.06*
Jack D. Wofford		0.091*	-0.06
Donnie Ray Jr. (2)	5/20/91	0.061*	-0.06*
Sunflower (1)		0.137	-0.03
American Beauty (1)		0.214	-0.059
Sierra Dawn	5/21/91	0.046	-0.044
Cooperative Vanguard		0.031	-0.03
Cindy J. Erickson		0.091	-0.049
Frank H. Peavy		0.076*	0*
Helen M. Clements		0.153	-0.045
Sunflower (2)		0.106	~0*
Dell Butcher (2)		0.061	-0.06
Hornet		0.138	-0.03
Volunteer State		0.168	-0.049
Enterprise Star		0.137	-0.095
Edward J. Hancock	5/22/91	0.065*	-0.03*
Joe/Nut		0.091*	
Starfire		0.091*	-0.061*
Conti-Karla			-0.031
American Beauty (2)		0.107	-0.061

*taken from a staff gage reading

Clarks Ferry Site, Trip 2

<i>Name</i>	<i>Date</i>	<i>Maximum wave height (m)*</i>	<i>Maximum drawdown (m)*</i>
C.W. Rushing	10/17/91	0.12	-0.12
Evey-T		0.08	-0.06
Sunflower		0.02	-0.02
Evelyn C.		0.08	-0.05
Sunflower		0.08	-0.01
Conti-Afton		0.05	-0.08
Night 1		0.1	-0.02
Night 2		0.08	-0.02
Night 3		0.05	-0.02
Lady Lone Star	10/18/91	0.06	-0.02
Lady Lone Star		0.06	-0.01
Kevin Michael		0.05	-0.02
Deborah Valentine		0.03	-0.05
Volunteer State		0.17	-0.11
Sunflower		0.14	-0.02
Frank Stegbauer		0.17	-0.14
Joshua		0.03	-0.02
Kathy Ellen	10/19/91	0.09	-0.04
Jack Bullard		0.05	-0.07
Marc		0.05	-0.02
Conti-Nan		0.08	-0.02
Cristina Ecstein		0.04	-0.02
Coast Guard 65504		0.2	-0.01
Prairie Dawn		0.11	-0.05
Noname	10/20/91	0.06	-0.02
Coop. ambassador		0.01	-0.02
Yazoo City		0.08	-0.05
George W. Banta		0.02	-0.04

*taken from a staff gage reading

APPENDIX XIII.

**SUSPENDED SEDIMENT CONCENTRATION DATA
FOR MCEVER'S ISLAND**

McEver's Island Site

60 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
Mary Ellen	5/17/89	-	-	-	-	-	-	-	-	
Elaine Jones		-	-	-	-	-	-	-	-	
Nicolas Duncan		63.6	75.0	63.7	54.4	48.3	53.4	56.3	67.5	
Mobil Leader	5/18/89	-	-	-	-	-	-	-	-	
Reliance		65.8	62.8	43.4	55.4	48.8	67.0	60.6	52.8	
Cooperative Vanguard		67.6	62.5	70.0	58.2	48.2	65.2	58.8	41.6	
Marvin E. Norman		107.0	63.1	101.6	70.0	67.9	69.7	61.1	44.4	
Illini		81.0	94.0	106.5	120.3	-	82.3	74.7	77.0	

30 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
Mary Ellen	5/17/89	-	-	-	-	-	-	-	-	
Elaine Jones		-	-	-	-	-	-	-	-	
Nicolas Duncan		66.0	90.2	64.8	52.7	54.2	53.6	60.7	70.0	
Mobil Leader	5/18/89	39.0	37.0	53.6	47.1	38.6	42.6	32.4	40.9	
Reliance		76.8	63.2	65.0	56.2	47.4	66.8	60.0	42.6	
Cooperative Vanguard		109.4	62.6	116.3	71.5	71.8	69.3	60.6	44.2	
Marvin E. Norman		152.5	102.0	171.0	125.0	78.7	128.7	96.0	71.3	
Illini		53.0	56.4	93.2	94.0	-	68.8	64.9	60.4	

McEver's Island Site

10 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
Mary Ellen Elaine Jones Nicolas Duncan	5/17/89	-	-	-	-	-	-	-	-	
		29.0	29.0	42.3	34.0	32.7	37.3	34.0	30.7	
		60.3	92.3	67.7	56.3	50.7	53.8	54.7	49.3	
Mobil Leader Reliance Cooperative Vanguard Marvin E. Norman Illini	5/18/89	42.6	38.2	47.3	45.1	37.2	43.6	41.6	43.3	
		105.4	63.5	91.9	65.4	65.3	69.9	61.5	44.5	
		158.0	88.5	156.0	102.7	86.3	106.0	97.7	78.3	
		129.0	100.0	381.3	85.4	96.6	113.0	99.3	70.0	
		65.7	95.0	144.6	100.1	-	68.9	65.6	57.4	

5 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
Mary Ellen	5/17/89	28.0	28.5	145.0	32.7	32.0	34.0	34.7	31.4	
Elaine Jones		161.0	29.0	40.0	34.0	31.0	35.0	35.7	32.0	
Nicolas Duncan		60.7	87.2	65.7	56.5	52.8	53.8	53.4	49.7	
Mobil Leader	5/18/89	44.3	38.7	44.2	43.8	35.8	43.9	41.9	38.0	
Reliance		109.4	62.6	116.3	71.5	71.8	69.3	60.6	44.2	
Cooperative Vanguard		154.5	102.0	142.7	103.0	84.0	128.3	92.0	74.0	
Marvin E. Norman		135.0	106.0	293.3	82.7	72.0	87.3	81.7	62.0	
Illini		57.3	100.0	118.6	95.7	-	66.1	64.4	58.6	

McEver's Island Site

2 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
Mary Ellen	5/17/89	29.0	29.0	42.0	33.3	33.3	37.0	34.3	30.0	
Elaine Jones		385.0	166.0	352.0	119.0	66.0	377.0	100.3	43.0	
Nicolas Duncan		64.7	84.6	66.7	55.9	55.4	53.8	52.8	50.6	
Mobil Leader	5/18/89	48.0	39.0	59.7	43.0	35.2	75.3	49.0	35.8	
Reliance		101.0	62.0	126.7	73.0	75.7	69.7	60.0	44.1	
Cooperative Vanguard		183.0	111.5	201.0	111.7	76.0	119.3	96.8	70.0	
Marvin E. Norman		150.5	111.0	144.0	86.7	78.0	89.3	87.3	61.0	
Illini		57.0	121.0	103.0	93.0	-	62.0	63.5	60.3	

Peak Suspended Sediment Concentrations

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
Mary Ellen	5/17/89	292.0	58.0	145.0	35.0	34.0	149.0	37.0	33.0	
Elaine Jones		385.0	245.0	352.0	145.7	134.0	377.0	140.0	96.7	
Nicolas Duncan		70.0	87.2	68.0	56.5	59.2	53.8	53.4	52.7	
Mobil Leader	5/18/89	469.0	244.0	310.0	105.0	115.0	230.0	152.0	89.0	
Reliance		431.0	143.0	304.0	177.0	101.0	187.0	119.0	52.0	
Cooperative Vanguard		389.0	243.0	322.0	125.0	84.7	199.0	126.0	83.7	
Marvin E. Norman		298.0	140.0	293.0	88.0	88.0	99.0	89.0	72.3	
Illini		78.0	155.0	168.0	108.0	-	82.0	72.0	64.0	

McEver's Island Site

Average Suspended Sediment Concentrations

Tow name	Date	Average Suspended Sediment Concentration during Event, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
Mary Ellen Elaine Jones Nicolas Duncan	5/17/89	29.0	29.0	41.0	33.3	32.0	37.7	35.0	31.0	
		130.0	206.0	344.0	145.7	134.0	232.3	135.3	61.0	
		67.3	82.8	67.3	55.4	57.2	53.8	52.4	51.3	
Mobil Leader Reliance Cooperative Vanguard Marvin E. Norman Illini	5/18/89	260.0	36.0	93.0	39.7	52.7	138.0	76.7	36.0	
		261.0	60.0	128.0	63.0	66.3	71.0	60.7	42.3	
		295.0	182.0	257.3	85.0	75.3	139.7	101.0	71.3	
		157.5	104.0	125.0	88.0	84.7	94.3	84.0	63.0	
		56.0	147.5	92.5	107.0	-	75.3	66.0	63.0	

2 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
Mary Ellen	5/17/89	29.5	29.0	42.0	32.0	30.0	37.0	37.0	31.0	
Elaine Jones		149.0	144.5	317.3	115.0	129.3	150.7	140.0	77.7	
Nicolas Duncan		70.0	81.0	68.0	55.0	59.0	53.8	52.0	52.2	
Mobil Leader	5/18/89	356.5	244.0	237.6	60.3	88.0	199.3	113.7	38.0	
Reliance		382.0	68.0	245.3	97.7	45.0	148.3	79.0	39.0	
Cooperative Vanguard		389.0	206.5	310.0	93.7	75.7	199.0	111.7	75.3	
Marvin E. Norman		140.0	106.0	165.0	80.0	82.3	99.0	76.0	66.3	
Illini		78.0	147.5	133.5	81.0	-	79.7	72.0	59.7	

McEver's Island Site

5 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1 Station c2 Station c3
Mary Ellen	5/17/89	292.0	29.0	144.0	35.0	31.0	149.0 35.0 33.0
Elaine Jones		123.5	58.0	239.0	121.0	113.7	131.3 128.0 96.7
Nicolas Duncan		67.3	75.8	66.6	53.7	59.2	53.8 52.2 52.7
Mobil Leader	5/18/89	121.0	148.0	286.0	101.7	115.0	170.7 139.0 89.0
Reliance		132.0	132.5	266.0	150.0	101.0	155.7 119.0 52.0
Cooperative Vanguard		158.0	108.0	322.0	102.3	84.7	147.0 123.0 83.7
Marvin E. Norman		298.0	140.0	126.0	80.7	73.3	81.0 72.0 72.3
Illini		67.5	79.0	100.0	108.0	-	73.7 63.0 62.0

30 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1 Station c2 Station c3
Mary Ellen	5/17/89	89.1	85.0	103.5	86.0	79.0	99.8 102.9 81.0
Elaine Jones		76.5	141.0	82.0	74.0	61.5	84.0 79.0 67.0
Nicolas Duncan		64.0	92.0	89.0	77.6	77.0	79.3 73.0 70.0
Mobil Leader	5/18/89	61.5	58.0	87.7	86.7	50.0	71.0 64.3 49.3
Reliance		158.0	108.0	322.0	102.3	84.7	147.0 123.0 83.7
Cooperative Vanguard		140.0	119.5	152.0	76.0	76.7	93.0 72.0 68.7
Marvin E. Norman		66.0	73.0	81.8	90.0	79.8	68.5 65.5 65.5
Illini		72.0	168.0	81.6	52.0	-	68.5 62.9 57.0

McEver's Island Site

60 Minutes after Barge-Tow Passage

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>					
		<i>Station a1</i>	<i>Station a2</i>	<i>Station b1</i>	<i>Station b2</i>	<i>Station b3</i>	<i>Station c1</i> <i>Station c2</i> <i>Station c3</i>
Mary Ellen	5/17/89	58.0	76.0	66.0	60.0	59.0	71.0 68.0 63.0
Elaine Jones		58.0	75.0	61.0	59.0	53.0	64.0 62.0 54.0
Nicolas Duncan		72.0	90.0	155.0	86.0	62.0	75.0 75.0 67.5
Mobil Leader	5/18/89	112.0	84.3	123.0	86.2	55.0	65.3 61.0 52.3
Reliance		199.0	126.0	112.0	99.3	79.3	81.0 72.7 73.3
Cooperative Vanguard		63.0	70.9	80.2	89.6	73.4	74.0 72.0 70.0
Marvin E. Norman		134.3	57.2	189.9	108.2	-	73.3 67.0 60.2
Illini		84.0	63.0	67.0	63.0	-	68.0 66.0 64.0

90 Minutes after Barge-Tow Passage

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>					
		<i>Station a1</i>	<i>Station a2</i>	<i>Station b1</i>	<i>Station b2</i>	<i>Station b3</i>	<i>Station c1</i> <i>Station c2</i> <i>Station c3</i>
Mary Ellen	5/17/89	51.8	99.1	52.3	65.2	43.0	57.7 54.5 46.5
Elaine Jones		53.6	74.5	52.9	54.4	43.0	54.7 48.3 45.3
Nicolas Duncan		68.0	77.0	75.5	-	64.0	67.0 70.0 58.0
Mobil Leader	5/18/89	68.6	65.6	48.3	56.8	51.6	63.5 57.3 52.1
Reliance		57.7	64.5	76.8	87.2	65.2	67.5 64.5 67.2
Cooperative Vanguard		132.0	64.2	191.6	108.2	-	73.1 66.8 59.3
Marvin E. Norman		65.0	84.5	98.5	86.0	-	71.3 60.0 65.3
Illini		65.1	60.4	48.1	53.6	-	67.3 60.1 61.9

McEver's Island Site

120 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
Mary Ellen	5/17/89	48.3	63.3	47.3	44.7	39.2	49.3	48.3	44.1	
Elaine Jones		46.1	60.6	47.0	45.4	39.8	49.4	48.0	42.4	
Nicolas Duncan		-	-	-	-	-	-	-	-	
Mobil Leader	5/18/89	63.9	62.2	72.0	57.4	47.4	64.4	58.3	41.2	
Reliance		87.0	84.8	165.6	165.5	-	70.9	66.2	57.7	
Cooperative Vanguard		71.0	128.0	85.0	106.5	-	69.7	61.0	65.3	
Marvin E. Norman		85.3	144.0	77.7	57.3	-	70.9	64.3	59.3	
Illini		72.6	63.6	59.2	98.4	-	77.4	67.9	60.4	

APPENDIX XIV.
SUSPENDED SEDIMENT CONCENTRATION DATA
FOR APPLE RIVER ISLAND

Apple River Island Site

60 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	-	-	-	-	-	-
Rusty Flowers		49.7	81.6	60.3	63.8	63.6	60.8
Tom Talbert		85.6	70.7	66.8	62.5	71.1	61.9
Herman Pott		66.2	71.4	106.9	63.1	72.8	62.9
Walter Brunson	5/21/90	-	-	-	-	-	-
Dell Butcher		55.7	65.9	73.6	57.4	75.6	67.2
Mary Gail		59.6	69.0	77.9	64.1	84.5	66.1
T.S. Kunsman		58.8	73.0	79.1	55.9	80.6	70.8
D. Ray Miller		64.8	71.0	79.6	60.5	78.4	69.7
Mary Gail	5/22/90	-	-	-	-	-	-
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-

Apple River Island Site

60 Minutes Prior to Barge-Tow Passage

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>					
		<i>Station a1</i>	<i>Station b1</i>	<i>Station c1</i>	<i>Station c2</i>	<i>Station d1</i>	<i>Station d2</i>
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		115.9	114.9	77.0	66.3	102.1	71.5
Trojan		121.6	121.2	76.3	67.4	98.9	70.7

30 Minutes Prior to Barge-Tow Passage

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>					
		<i>Station a1</i>	<i>Station b1</i>	<i>Station c1</i>	<i>Station c2</i>	<i>Station d1</i>	<i>Station d2</i>
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	-	-	-	-	-	-
Rusty Flowers		50.6	64.7	72.4	58.8	65.4	61.0
Tom Talbert		65.5	63.0	67.4	62.4	67.3	59.5
Herman Pott		76.8	74.7	76.3	83.5	65.3	63.0
Walter Brunson	5/21/90	60.0	66.1	74.0	142.7	79.1	64.5
Dell Butcher		96.1	83.8	91.6	101.9	73.8	64.4
Mary Gail		62.5	71.9	79.5	58.4	79.1	70.3
T.S. Kunsman		137.1	130.8	119.4	90.3	78.2	69.9
D. Ray Miller		143.8	123.6	83.7	80.2	87.3	68.6

Apple River Island Site

30 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Mary Gail	5/22/90	-	84.8	95.7	68.2	102.5	79.4
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		69.6	82.5	81.5	68.8	105.1	71.5
Trojan		66.7	76.8	79.3	68.5	94.2	72.1

XIV-5

10 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-

Apple River Island Site

10 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Merlin Banta	5/20/90	-	63.6	61.5	59.9	72.5	57.2
Rusty Flowers		108.9	63.5	68.3	59.8	72.2	59.9
Tom Talbert		58.1	72.2	75.1	61.1	68.4	65.6
Herman Pott		141.3	100.5	77.2	135.0	56.1	58.4
Walter Brunson	5/21/90	55.8	66.8	72.8	71.4	74.1	65.0
Dell Butcher		67.2	74.2	75.3	63.5	72.8	65.3
Mary Gail		154.8	145.9	129.3	97.4	78.2	70.0
T.S. Kunsman		132.2	111.9	80.1	70.3	97.3	66.3
D. Ray Miller		227.7	98.0	80.9	55.6	80.5	68.2
Mary Gail	5/22/90	250.3	93.9	94.5	67.1	93.5	78.8
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		65.3	73.2	79.1	68.1	90.3	71.1
Trojan		65.2	75.6	79.2	63.1	133.7	68.7

Apple River Island Site

5 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	54.6	61.9	65.1	60.8	77.5	60.5
Rusty Flowers		93.1	70.5	69.0	60.1	91.1	60.2
Tom Talbert		56.7	78.0	70.1	61.3	68.1	60.2
Herman Pott		130.4	109.6	75.5	97.1	60.5	61.0
Walter Brunson	5/21/90	55.7	65.9	73.6	57.4	75.6	67.2
Dell Butcher		61.0	67.9	75.0	62.6	72.0	63.7
Mary Gail		199.1	183.6	154.1	115.1	78.3	70.4
T.S. Kunsman		117.4	96.6	77.0	63.1	92.6	68.8
D. Ray Miller		161.4	108.6	81.1	61.1	85.8	71.9
Mary Gail	5/22/90	251.3	105.7	91.7	74.1	94.4	78.2
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		67.7	75.8	81.3	67.6	96.6	68.8
Trojan		72.7	75.7	99.3	66.2	88.1	68.0

Apple River Island Site

2 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W. A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	55.1	62.1	67.4	60.2	80.3	55.2
Rusty Flowers		81.7	75.6	69.9	60.2	81.4	60.4
Tom Talbert		57.6	70.7	70.7	60.7	69.0	63.2
Herman Pott		123.9	115.1	74.4	74.4	63.1	62.6
Walter Brunson	5/21/90	56.3	64.8	75.1	59.4	78.7	70.1
Dell Butcher		80.5	66.7	72.8	62.6	73.2	65.5
Mary Gail		225.7	206.3	169.0	125.7	78.3	70.6
T.S. Kunsman		97.5	87.6	77.4	63.7	214.1	72.5
D. Ray Miller		161.8	105.2	81.0	62.2	80.4	69.4
Mary Gail	5/22/90	228.1	112.8	91.4	78.4	92.7	77.8
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		63.3	77.3	80.9	67.3	125.8	67.3
Trojan		72.5	73.5	93.0	65.9	128.0	65.3

Apple River Island Site

Peak Suspended Sediment Concentrations

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	59.4	66.9	78.4	61.2	85.1	61.2
Rusty Flowers		107.9	77.9	80.5	61.6	192.6	61.6
Tom Talbert		265.1	178.1	91.3	65.0	75.8	66.2
Herman Pott		207.6	130.8	184.8	97.1	77.8	63.8
Walter Brunson	5/21/90	90.6	74.0	80.4	212.4	92.0	71.0
Dell Butcher		98.8	118.4	83.3	67.9	74.8	66.9
Mary Gail		225.7	213.9	169.0	129.3	82.3	72.1
T.S. Kunsman		256.0	97.7	82.3	67.3	328.3	72.5
D. Ray Miller		161.8	124.3	114.5	71.8	94.8	71.9
Mary Gail	5/22/90	251.6	173.8	98.7	78.4	94.7	80.0
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		72.7	77.3	99.3	67.6	152.6	69.7
Trojan		90.0	80.8	99.3	69.1	161.4	70.5

Apple River Island Site

Average Suspended Sediment Concentrations

Tow name	Date	Average Suspended Sediment Concentration during Event, mg/L				
		Station a1	Station b1	Station c1	Station c2	Station d1
Yazoo	5/18/90	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-
Christine Bailey		-	-	-	-	-
Kathy Ellen		-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-
Hornet		-	-	-	-	-
Conti-Bonnie		-	-	-	-	-
Becky Lynn		-	-	-	-	-
Merlin Banta	5/20/90	51.6	64.8	64.9	60.2	74.3
Rusty Flowers		82.9	77.9	75.5	56.3	73.6
Tom Talbert		65.5	64.1	70.1	57.8	68.2
Herman Pott		165.7	118.7	76.5	60.9	73.4
Walter Brunson	5/21/90	55.1	64.8	77.2	58.3	80.7
Dell Butcher		63.9	68.1	71.3	67.9	73.3
Mary Gail		210.0	192.1	109.8	110.2	77.9
T.S. Kunsman		105.1	85.3	77.0	66.2	328.3
D. Ray Miller		159.4	119.0	81.6	59.1	82.3
Mary Gail	5/22/90	188.7	131.8	90.5	69.4	88.3
Trojan		-	-	-	-	-
Melinda Brent		-	-	-	-	-
Corporate Mariner		-	-	-	-	-
Ed Renshaw		-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-
Jack D. Wofford		65.2	75.6	79.2	63.1	133.7
Trojan		82.3	76.1	84.5	65.3	126.8
						68.7
						66.4

Apple River Island Site

2 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	52.8	60.7	71.6	56.1	67.9	55.9
Rusty Flowers		81.8	72.9	79.0	61.4	76.8	59.3
Tom Talbert		107.1	70.0	83.2	60.1	71.4	65.5
Herman Pott		207.6	124.7	184.8	59.5	77.8	63.0
Walter Brunson	5/21/90	58.3	66.8	80.4	134.5	92.0	65.2
Dell Butcher		69.7	118.4	71.6	63.4	72.9	63.8
Mary Gail		178.2	151.1	94.4	106.0	76.0	70.7
T.S. Kunsman		136.0	87.8	74.9	63.6	84.4	69.7
D. Ray Miller		141.8	117.2	114.5	64.0	86.8	70.0
Mary Gail	5/22/90	169.9	173.8	88.7	69.9	87.1	80.0
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		69.8	76.6	84.8	65.2	112.1	68.6
Trojan		83.4	80.3	84.4	65.3	89.1	70.5

Apple River Island Site

5 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L				
		Station a1	Station b1	Station c1	Station c2	Station d1
Yazoo	5/18/90	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-
Christine Bailey		-	-	-	-	-
Kathy Ellen		-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-
Hornet		-	-	-	-	-
Conti-Bonnie		-	-	-	-	-
Becky Lynn		-	-	-	-	-
Merlin Banta	5/20/90	56.9	65.4	64.5	61.2	63.1
Rusty Flowers		107.9	72.1	75.4	61.6	192.6
Tom Talbert		265.1	178.1	90.7	60.0	75.8
Herman Pott		201.3	126.6	133.4	67.6	71.5
Walter Brunson	5/21/90	90.6	74.0	79.1	59.9	72.1
Dell Butcher		67.2	67.4	83.3	63.4	70.1
Mary Gail		147.9	126.0	85.7	86.1	82.3
T.S. Kunsman		244.1	97.7	82.3	59.5	151.1
D. Ray Miller		128.9	104.2	98.0	71.6	83.5
Mary Gail	5/22/90	155.7	160.7	98.7	72.7	93.0
Trojan		-	-	-	-	-
Melinda Brent		-	-	-	-	-
Corporate Mariner		-	-	-	-	-
Ed Renshaw		-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-
Jack D. Wofford		72.7	75.7	99.3	66.2	88.1
Trojan		79.1	80.8	83.2	67.1	93.9
						68.0
						69.4

Apple River Island Site

30 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	53.5	61.9	66.7	59.5	86.0	54.4
Rusty Flowers		69.6	82.3	70.1	61.3	73.8	61.1
Tom Talbert		114.6	85.1	73.2	62.3	74.9	63.1
Herman Pott		114.4	91.4	78.2	70.5	75.4	66.2
Walter Brunson	5/21/90	84.6	77.2	74.6	68.6	74.7	63.3
Dell Butcher		61.4	70.2	77.9	64.6	73.2	66.4
Mary Gail		173.6	104.4	78.4	61.5	76.8	72.0
T.S. Kunsman		105.0	87.6	83.5	64.9	76.6	68.1
D. Ray Miller		71.6	75.4	82.4	64.8	80.8	72.4
Mary Gail	5/22/90	84.9	87.8	95.1	76.7	89.2	77.3
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		70.7	73.8	83.1	67.5	91.1	65.7
Trojan		66.1	71.3	85.3	66.2	93.9	63.5

Apple River Island Site

60 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	64.8	65.5	71.7	59.5	65.9	61.3
Rusty Flowers		56.8	79.3	71.6	61.6	67.8	60.7
Tom Talbert		76.8	73.3	73.8	63.8	72.5	69.6
Herman Pott		-	-	-	-	-	-
Walter Brunson	5/21/90	67.2	67.4	83.3	63.4	70.1	65.9
Dell Butcher		72.1	68.4	79.9	67.2	81.4	69.9
Mary Gail		82.7	80.0	80.4	62.4	75.3	69.9
T.S. Kunsman		66.6	73.3	80.8	65.3	75.2	67.7
D. Ray Miller		59.2	76.2	80.9	60.2	85.9	73.9
Mary Gail	5/22/90	72.2	80.5	87.2	75.9	86.5	76.7
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		56.2	69.5	81.5	63.5	100.7	65.5
Trojan		56.3	71.4	78.3	64.5	91.4	80.4

Apple River Island Site

90 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station c1	Station c2	Station d1	Station d2
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Kernan	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	51.6	60.7	69.3	59.5	66.4	56.9
Rusty Flowers		168.2	181.6	80.0	65.1	74.1	65.1
Tom Talbert		86.9	69.6	85.2	65.0	72.7	68.9
Herman Pott		-	-	-	-	-	-
Walter Brunson	5/21/90	60.8	71.5	77.1	65.4	76.5	66.2
Dell Butcher		105.4	93.4	79.6	66.1	80.1	69.9
Mary Gail		66.5	74.1	79.4	67.8	83.7	75.5
T.S. Kunsman		85.3	73.8	81.7	89.5	102.7	77.5
D. Ray Miller		72.7	73.9	81.7	84.5	94.4	77.7
Mary Gail	5/22/90	92.6	77.8	88.8	82.1	89.2	76.0
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Cooperative Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		55.9	71.3	78.4	63.9	98.2	75.9
Trojan		52.6	70.2	76.1	64.5	85.6	95.0

Apple River Island Site

120 Minutes after Barge-Tow Passage

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>					
		<i>Station a1</i>	<i>Station b1</i>	<i>Station c1</i>	<i>Station c2</i>	<i>Station d1</i>	<i>Station d2</i>
Yazoo	5/18/90	-	-	-	-	-	-
Cooperative Ambassador		-	-	-	-	-	-
Christine Bailey		-	-	-	-	-	-
Kathy Ellen		-	-	-	-	-	-
W.A. Keman	5/19/90	-	-	-	-	-	-
Hornet		-	-	-	-	-	-
Conti-Bonnie		-	-	-	-	-	-
Becky Lynn		-	-	-	-	-	-
Merlin Banta	5/20/90	64.8	61.4	67.9	59.1	66.6	59.9
Rusty Flowers		107.0	71.6	77.7	62.9	72.2	63.9
Tom Talbert		63.3	70.5	113.5	62.9	71.9	63.0
Herman Pott		-	-	-	-	-	-
Walter Brunson	5/21/90	112.2	69.8	80.0	66.3	78.4	70.1
Dell Butcher		64.5	70.6	80.5	70.4	83.5	68.5
Mary Gail		71.6	72.0	82.3	95.1	118.3	82.6
T.S. Kunsman		66.5	75.9	81.4	77.0	88.3	76.1
D. Ray Miller		-	-	-	-	-	-
Mary Gail	5/22/90	72.7	85.7	95.0	70.3	87.2	66.2
Trojan		-	-	-	-	-	-
Melinda Brent		-	-	-	-	-	-
Corporate Mariner		-	-	-	-	-	-
Ed Renshaw		-	-	-	-	-	-
Kevin Michael	5/23/90	-	-	-	-	-	-
Jack D. Wofford		-	-	-	-	-	-
Trojan		-	-	-	-	-	-

APPENDIX XV.

**SUSPENDED SEDIMENT CONCENTRATION DATA
FOR GOOSE ISLAND, TRIP 1**

Goose Island Site, Trip 1

60 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L			
		Station a1	Station b1	Station b2	Station c2
Sierra Dawn	8/24/90	-	-	-	-
Dell Butcher		184.0	217.7	203.7	181.2
William C. Norman		187.2	211.4	204.5	178.5
Normania		159.7	198.3	195.0	181.1
Dave Carlton		191.8	208.0	194.7	182.1
Hugh C. Blaske	8/25/90	153.4	152.7	165.6	149.4
Teresa Renee		151.2	148.5	148.8	148.0
Trojan Warrior		154.9	151.1	157.7	154.7
Hoosier State		162.7	157.8	151.0	146.9
Reliance		-	-	-	-
Kevin Michael	8/26/90	161.3	153.9	154.0	147.7
Sumac		172.1	168.3	159.9	155.8
Twin Cities		168.4	166.2	166.1	147.6
Cooperative Vanguard		170.3	175.9	165.5	158.6
Superior		-	-	-	-
Helen M. Clements	8/27/90	165.6	179.4	171.8	264.5

Goose Island Site, Trip 1

30 Minutes Prior to Barge-Tow Passage

Tow name	Suspended Sediment Concentration, mg/L					
	Date	Station a1	Station b1	Station b2	Station c1	Station c2
Sierra Dawn	8/24/90	-	-	-	-	-
Dell Butcher		168.7	201.8	198.1	203.7	180.0
William C. Norman		187.1	215.7	197.6	287.9	181.8
Normania		283.9	222.4	223.5	325.4	180.1
Dave Carlton		191.2	193.4	179.6	188.4	174.1
Hugh C. Blaske	8/25/90	158.8	149.6	149.1	164.4	147.8
Teresa Renee		168.9	146.5	151.7	163.0	151.9
Trojan Warrior		155.1	147.2	143.3	164.2	150.7
Hoosier State		162.1	153.1	152.5	160.6	189.1
Reliance	8/26/90	-	-	-	-	-
Kevin Michael		156.9	147.8	151.4	166.3	146.7
Sumac		163.2	158.2	156.8	173.0	149.8
Twin Cities		173.2	165.4	163.0	181.3	158.7
Cooperative Vanguard		187.9	174.2	164.3	184.7	155.5
Superior	8/27/90	-	-	-	-	-
Helen M. Clements		167.8	178.2	170.0	202.8	192.0

Goose Island Site, Trip 1

10 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station b2	Station c1	Station c2	
Sierra Dawn	8/24/90	-	-	-	-	-	-
Dell Butcher		189.1	229.2	201.7	494.5	179.5	179.5
William C. Norman		331.5	251.8	237.8	253.0	186.2	186.2
Normania		217.3	228.0	199.0	204.5	269.1	269.1
Dave Carlton		182.2	188.5	179.6	189.7	176.2	176.2
Hugh C. Blaske	8/25/90	155.7	148.9	148.6	164.0	148.1	148.1
Teresa Renee		152.5	164.1	136.7	164.4	146.0	146.0
Trojan Warrior		164.4	162.3	140.6	160.0	149.1	149.1
Hoosier State		160.5	153.3	151.0	160.0	158.0	158.0
Reliance	8/26/90	-	-	-	-	-	-
Kevin Michael		149.6	155.0	151.6	167.8	145.6	145.6
Sumac		163.7	163.4	160.6	171.1	147.6	147.6
Twin Cities		168.3	170.0	158.6	173.7	153.0	153.0
Cooperative Vanguard		186.8	168.2	157.1	176.1	153.7	153.7
Superior	8/27/90	229.7	222.3	201.5	223.3	181.3	181.3
Helen M. Clements		180.3	190.3	179.3	244.8	178.6	178.6

Goose Island Site, Trip 1

5 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L				
		Station a1	Station b1	Station b2	Station c1	Station c2
Sierra Dawn	8/24/90	-	-	-	-	-
Dell Butcher		190.5	238.8	204.6	642.1	177.9
William C. Norman		258.4	217.1	204.7	217.1	177.0
Normania		214.9	199.5	190.9	202.0	199.6
Dave Carlton		182.7	187.7	180.6	191.3	177.2
Hugh C. Blaske	8/25/90	152.0	148.6	148.8	164.5	148.0
Teresa Renee		156.2	161.3	138.4	166.7	148.6
Trojan Warrior		164.2	156.4	139.6	165.2	146.9
Hoosier State		160.4	153.3	151.0	160.7	146.8
Reliance	8/26/90	-	-	-	-	-
Kevin Michael		150.0	158.7	152.0	166.7	146.2
Sumac		166.0	165.0	164.4	170.3	147.3
Twin Cities		245.4	171.0	160.6	172.7	153.0
Cooperative Vanguard		186.3	173.0	155.5	177.7	152.8
Superior	8/27/90	258.7	235.8	211.0	234.1	184.9
Helen M. Clements		253.4	195.0	182.8	241.4	187.5

Goose Island Site, Trip 1

2 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L				
		Station a1	Station b1	Station b2	Station c1	Station c2
Sierra Dawn	8/24/90	-	-	-	-	-
Dell Butcher		303.4	207.6	207.1	211.6	181.3
William C. Norman		232.3	206.3	208.2	199.9	185.0
Normania		254.0	201.1	195.4	200.4	237.6
Dave Carlton		183.0	187.2	181.2	192.2	177.8
Hugh C. Blaske	8/25/90	149.7	148.4	148.9	164.7	148.0
Teresa Renee		160.9	162.5	144.0	162.3	155.4
Trojan Warrior		159.4	158.8	141.7	164.5	149.5
Hoosier State		160.2	153.2	152.0	162.8	145.4
Reliance	8/26/90	-	-	-	-	-
Kevin Michael		152.6	158.2	152.6	167.7	147.3
Sumac		173.0	168.4	169.4	172.1	148.3
Twin Cities		269.9	169.3	163.5	183.6	153.8
Cooperative Vanguard		183.9	174.7	155.6	180.3	154.2
Superior	8/27/90	276.2	243.9	216.8	240.6	187.1
Helen M. Clements		359.8	198.5	185.3	225.0	199.6

Goose Island Site, Trip 1

Peak Suspended Sediment Concentrations for the Events

Tow name	Date	Suspended Sediment Concentration, mg/L				
		Station a1	Station b1	Station b2	Station c1	Station c2
Sierra Dawn	8/24/90	-	-	-	-	-
Dell Butcher		331.5	251.8	241.7	642.1	190.0
William C. Norman		258.4	217.1	211.8	233.3	235.7
Normania		267.7	215.7	210.1	203.4	276.9
Dave Carlton		198.8	191.7	191.2	192.2	178.0
Hugh C. Blaske	8/25/90	154.9	153.3	159.7	193.4	155.3
Teresa Renee		164.4	162.6	144.0	166.7	155.4
Trojan Warrior		192.7	168.8	143.7	185.7	276.5
Hoosier State		160.4	166.5	153.9	178.9	194.1
Reliance	8/26/90	-	-	-	-	-
Kevin Michael		158.9	160.9	154.0	179.6	147.3
Sumac		194.5	176.2	181.0	197.1	155.2
Twin Cities		297.0	182.7	173.2	195.2	160.2
Cooperative Vanguard		187.0	179.0	163.6	190.8	155.1
Superior	8/27/90	305.2	257.4	236.3	258.4	198.7
Helen M. Clements		359.8	225.8	215.6	252.3	265.3

Goose Island Site, Trip 1

Average Suspended Sediment Concentrations

Tow name	Date	Average Suspended Sediment Concentration during Event, mg/L			
		Station a1	Station b1	Station b2	Station c2
Sierra Dawn	8/24/90	-	-	-	-
Dell Butcher		292.4	204.3	203.5	223.2
William C. Norman		231.7	212.5	204.1	196.1
Normania		248.6	203.0	189.3	200.0
Dave Carlton		180.5	185.1	186.3	189.8
Hugh C. Blaske	8/25/90	151.8	148.8	149.0	169.9
Teresa Renee		159.6	159.8	137.2	158.1
Trojan Warrior		163.8	163.0	139.1	179.8
Hoosier State		157.6	153.0	152.6	167.6
Reliance		-	-	-	-
Kevin Michael	8/26/90	154.4	156.3	154.0	174.9
Sumac		170.1	170.6	179.7	175.6
Twin Cities		217.5	170.0	164.4	194.4
Cooperative Vanguard		184.6	177.2	155.7	184.5
Superior		287.8	249.3	220.6	244.9
Helen M. Clements	8/27/90	290.5	204.3	193.4	210.8
					188.6
					234.5

Goose Island Site, Trip 1

2 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L				
		Station a1	Station b1	Station b2	Station c1	Station c2
Sierra Dawn	8/24/90	-	-	-	-	-
Dell Butcher		250.5	228.4	233.9	252.4	190.0
William C. Norman		213.7	210.7	198.2	201.5	213.8
Normania		229.2	205.2	210.1	200.8	188.0
Dave Carlton		193.2	187.0	184.6	188.0	173.9
Hugh C. Blaske	8/25/90	153.5	151.3	159.7	184.2	149.2
Teresa Renee		159.4	156.6	137.1	160.5	145.6
Trojan Warrior		192.7	163.6	139.4	177.1	150.2
Hoosier State		156.0	151.1	146.0	166.3	142.2
Reliance	8/26/90	-	-	-	-	-
Kevin Michael		156.2	156.0	149.9	175.8	146.8
Sumac		179.7	172.9	176.0	187.8	150.9
Twin Cities		181.4	177.5	162.1	194.9	154.1
Cooperative Vanguard		186.5	176.3	160.6	189.2	152.2
Superior	8/27/90	299.4	254.7	224.4	249.2	190.1
Helen M. Clements		275.9	198.1	195.4	209.9	225.6

Goose Island Site, Trip 1

5 Minutes after Barge-Tow Passage

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>			
		<i>Station a1</i>	<i>Station b1</i>	<i>Station b2</i>	<i>Station c2</i>
Sierra Dawn	8/24/90	-	-	-	-
Dell Butcher		296.1	225.1	232.6	449.9
William C. Norman		205.7	207.5	183.8	204.4
Normania		222.6	215.7	199.1	203.2
Dave Carlton		194.3	191.7	177.3	188.1
Hugh C. Blaske	8/25/90	154.9	151.1	157.7	169.8
Teresa Renee		164.4	157.0	140.6	165.6
Trojan Warrior		190.8	168.8	143.7	185.7
Hoosier State		156.3	166.5	153.9	178.9
Reliance	8/26/90	-	-	-	-
Kevin Michael		158.9	154.8	151.8	167.8
Sumac		193.7	176.2	181.0	178.1
Twin Cities		169.0	172.6	169.0	181.1
Cooperative Vanguard		176.8	176.3	163.6	190.8
Superior	8/27/90	296.3	252.7	236.3	258.4
Helen M. Clements		259.7	225.8	215.6	252.3
					198.7
					208.1

Goose Island Site, Trip 1

30 Minutes after Barge-Tow Passage

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>			
		<i>Station a1</i>	<i>Station b1</i>	<i>Station b2</i>	<i>Station c2</i>
Sierra Dawn	8/24/90	-	-	-	-
Dell Butcher		218.9	201.5	194.4	204.1
William C. Norman		232.5	211.6	203.2	204.7
Normania		228.1	220.4	210.1	211.0
Dave Carlton		183.0	196.1	195.7	190.2
Hugh C. Blaske	8/25/90	157.3	140.3	151.0	163.5
Teresa Renee		200.1	176.5	153.3	170.5
Trojan Warrior		204.1	169.1	153.4	172.7
Hoosier State		194.6	168.5	203.1	168.1
Reliance	8/26/90	-	-	-	-
Kevin Michael		163.4	165.8	158.6	174.4
Sumac		168.4	169.2	164.4	178.8
Twin Cities		186.5	171.1	156.1	177.1
Cooperative Vanguard		175.3	173.9	161.5	188.7
Superior	8/27/90	220.9	202.2	192.4	221.8
Helen M. Clements		194.7	204.9	193.1	214.8
					180.7
					278.1

Goose Island Site, Trip 1

60 Minutes after Barge-Tow Passage

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>			
		<i>Station a1</i>	<i>Station b1</i>	<i>Station b2</i>	<i>Station c2</i>
Sierra Dawn	8/24/90	-	-	-	-
Dell Butcher		228.4	220.6	211.4	217.3
William C. Norman		207.3	210.4	204.5	204.9
Normania		218.9	201.5	194.4	198.1
Dave Carlton		174.8	185.4	211.4	188.6
Hugh C. Blaske	8/25/90	164.2	156.4	139.6	165.2
Teresa Renee		284.2	175.5	186.7	196.3
Trojan Warrior		272.5	206.7	197.7	208.1
Hoosier State		191.0	155.2	154.8	162.8
Reliance	8/26/90	-	-	-	-
Kevin Michael		166.2	163.8	159.4	180.9
Sumac		169.8	177.7	173.2	188.2
Twin Cities		188.0	174.1	161.3	174.2
Cooperative Vanguard		170.2	171.7	163.1	180.6
Superior	8/27/90	163.3	184.1	173.8	203.9
Helen M. Clements		171.9	238.4	176.7	205.3
					206.3
					174.1

Goose Island Site, Trip 1

90 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L				
		Station a1	Station b1	Station b2	Station c1	Station c2
Sierra Dawn	8/24/90	-	-	-	-	-
Dell Butcher		218.7	202.8	193.3	199.3	179.8
William C. Norman		213.6	199.0	191.0	200.1	179.6
Normania		234.3	195.9	188.3	190.6	176.7
Dave Carlton	8/25/90	-	-	-	-	-
Hugh C. Blaske		193.0	169.7	152.2	175.0	156.5
Teresa Renee		194.9	178.6	171.6	174.4	154.8
Trojan Warrior		181.0	167.7	163.9	172.4	264.1
Hoosier State		-	-	-	-	-
Reliance	8/26/90	-	-	-	-	-
Kevin Michael		163.7	163.4	160.4	171.1	147.6
Sumac		184.7	174.2	155.6	179.4	153.7
Twin Cities		168.4	173.6	166.7	185.2	157.6
Cooperative Vanguard	8/27/90	159.9	167.2	154.7	188.0	154.2
Superior		163.9	178.3	170.2	487.8	236.4
Helen M. Clements		162.0	179.4	169.7	186.7	158.8

Goose Island Site, Trip 1

120 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station b1	Station b2	Station c1	Station c2	
Sierra Dawn	8/24/90	-	-	-	-	-	-
Dell Butcher		206.0	204.0	192.6	192.5	180.3	
William C. Norman		216.3	195.8	184.0	190.2	174.9	
Normania		182.2	190.5	177.7	186.8	174.1	
Dave Carlton		-	-	-	-	-	-
Hugh C. Blaske	8/25/90	260.1	196.8	197.0	198.7	257.1	
Teresa Renee		165.3	161.2	153.6	165.8	175.5	
Trojan Warrior		162.9	160.5	151.7	165.4	147.5	
Hoosier State		-	-	-	-	-	-
Reliance	8/26/90	-	-	-	-	-	-
Kevin Michael		175.0	164.2	163.0	178.5	151.7	
Sumac		189.4	232.7	162.4	186.8	158.1	
Twin Cities		165.6	164.8	154.8	182.2	152.6	
Cooperative Vanguard		-	-	-	-	-	-
Superior	8/27/90	168.9	181.1	172.4	205.0	251.4	
Helen M. Clements		151.4	174.2	166.8	180.2	160.9	

APPENDIX XVI.

SUSPENDED SEDIMENT CONCENTRATION DATA
FOR KAMPSVILLE, TRIP 1

Kampsville Site, Trip 1
60 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2	Station d3
Mr. Aldo	10/12/90	95.1	91.1	159.0	138.8	195.3	-	-	-	-
Floyd Blaske		95.9	92.2	162.3	140.5	198.9	-	-	-	-
Luke Burton	10/13/90	-	-	-	-	-	-	-	-	-
Sugarland		-	-	-	-	-	-	-	-	-
William C. Norman		312.0	288.9	245.5	220.6	291.4	244.0	-	-	-
Frank H. Peavey		153.7	147.5	-	-	296.2	244.7	-	-	-
Conti-Karla		181.1	173.4	-	-	349.8	252.9	-	-	-
Mr. Paul	10/14/90	227.6	214.8	317.8	414.0	-	-	-	-	-
Rambler		202.7	188.3	284.8	258.8	-	-	-	-	-
Mr. Lawrence		318.5	300.7	373.2	389.7	-	-	-	-	-
Mallard		215.7	171.5	300.6	933.7	-	-	-	-	-
Charles Lehman		248.6	223.0	304.2	274.5	-	-	-	-	-
Nicholas Duncan		-	-	-	-	-	-	-	-	-
Ardyce Randall	10/15/90	-	-	-	-	-	-	-	-	-
Mr. Paul		206.0	188.8	287.3	268.0	419.7	284.2	-	-	-
Exxon St. Louis		193.4	183.6	297.2	270.6	367.5	296.5	-	-	-
Margaret O		190.0	181.4	296.3	267.4	369.7	300.9	-	-	-
Mr. Lawrence		-	-	-	-	-	-	-	-	-

Kampsville Site, Trip 1

60 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2
A. L. Smith Ste. Genevieve	10/16/90	201.7	200.6	255.4	234.7	499.8	315.5	-	-
		246.2	217.7	-	-	338.3	265.8	453.8	316.0
Nicole Brent Frank H. Peavey	10/17/90	-	-	-	-	-	-	-	-
		182.9	186.0	226.3	194.0	-	-	-	-
									482.8

30 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2
Mr. Aldo Floyd Blaske	10/12/90	96.9	93.5	166.1	142.3	203.1	-	-	-
		97.8	94.6	169.4	143.9	206.7	-	-	-
Luke Burton Sugarland	10/13/90	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
William C. Norman Frank H. Peavey		333.4	293.4	263.2	231.6	303.2	226.4	-	-
		157.6	137.6	-	-	292.4	233.9	-	-
Conti-Karla		201.1	193.2	-	-	313.7	269.0	-	-

Kampsville Site, Trip 1

30 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2	Station d3
Mr. Paul	10/14/90	208.9	194.2	284.0	272.3	-	-	-	-	-
Rambler		186.2	178.6	290.9	268.0	-	-	-	-	-
Mr. Lawrence		242.4	223.6	332.0	297.2	-	-	-	-	-
Mallard		336.8	327.0	302.1	268.7	-	-	-	-	-
Charles Lehman		230.1	209.3	306.7	265.3	-	-	-	-	-
Nicholas Duncan		-	-	-	-	-	-	-	-	-
Ardyce Randall	10/15/90	-	-	-	-	-	-	-	-	-
Mr. Paul		195.6	176.9	280.4	246.5	385.9	279.1	-	-	-
Exxon St. Louis		205.3	190.6	308.6	277.4	356.7	292.2	-	-	-
Margaret O		215.6	192.7	314.0	281.9	356.3	288.2	-	-	-
Mr. Lawrence		-	-	-	-	-	-	-	-	-
A. L. Smith	10/16/90	229.8	185.2	230.2	215.6	552.7	242.4	-	-	-
Ste. Genevieve		228.1	202.7	-	-	339.2	278.6	444.9	354.2	475.7
Nicole Brent	10/17/90	181.1	184.4	217.5	187.5	-	-	-	-	-
Frank H. Peavey		222.7	221.7	240.1	208.1	-	-	-	-	-

Kampsville Site, Trip 1

10 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2
Mr. Aldo	10/12/90	97.7	94.7	172.5	151.5	207.4	-	-	-
Floyd Blaske		99.4	98.5	173.6	153.0	211.1	-	-	-
Luke Burton	10/13/90	-	-	-	-	-	-	-	-
Sugarland		139.5	127.6	220.0	199.1	274.8	227.0	-	-
William C. Norman		176.2	161.4	256.4	218.7	319.4	253.8	-	-
Frank H. Peavey		145.0	139.8	-	-	293.6	237.5	-	-
Conti-Karla		179.9	171.9	-	-	370.1	446.1	-	-
Mr. Paul	10/14/90	193.9	179.7	293.3	267.4	-	-	-	-
Rambler		307.2	291.3	360.8	416.6	-	-	-	-
Mr. Lawrence		233.1	217.6	315.0	262.9	-	-	-	-
Mallard		256.0	234.0	310.8	275.3	-	-	-	-
Charles Lehman		229.3	214.6	275.9	254.1	-	-	-	-
Nicholas Duncan		-	-	-	-	-	-	-	-
Ardyce Randall	10/15/90	211.2	198.8	334.1	269.9	357.7	296.7	-	-
Mr. Paul		198.7	177.1	279.7	232.3	336.7	278.5	-	-
Exxon St. Louis		227.1	187.2	314.9	283.1	371.6	287.1	-	-
Margaret O		347.1	249.6	316.0	284.4	398.8	292.0	-	-
Mr. Lawrence		-	-	-	-	-	-	-	-
A. L. Smith	10/16/90	229.6	179.3	230.5	211.2	557.8	275.1	-	-
Ste. Genevieve		233.9	211.3	-	-	331.7	283.2	426.6	349.1
Nicole Brent	10/17/90	182.5	185.4	227.4	194.7	-	-	-	-
Frank H. Peavey		204.5	205.7	239.1	212.7	-	-	-	-
								457.6	

Kampsville Site, Trip 1

5 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L									
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2	Station d3	
Mr. Aldo Floyd Blaske	10/12/90	97.5	94.7	175.3	158.9	207.7	-	-	-	-	
		108.9	100.9	210.4	163.7	204.4	-	-	-	-	
Luke Burton Sugarland William C. Norman Frank H. Peavey Conti-Karla	10/13/90	138.8	128.4	219.4	198.8	277.3	229.6	-	-	-	
		135.8	131.5	217.1	197.8	287.2	239.9	-	-	-	
		172.0	155.9	257.6	230.6	316.9	259.3	-	-	-	
		145.0	140.7	-	-	287.9	235.9	-	-	-	
		182.4	172.1	-	-	537.4	265.9	-	-	-	
Mr. Paul Rambler Mr. Lawrence Mallard Charles Lehman Nicholas Duncan	10/14/90	197.5	183.4	289.6	271.4	-	-	-	-	-	
		290.4	278.3	348.5	386.8	-	-	-	-	-	
		220.6	208.5	303.5	260.7	-	-	-	-	-	
		238.5	221.7	298.3	261.1	-	-	-	-	-	
		230.3	218.6	339.6	271.6	-	-	-	-	-	
Ardyce Randall Mr. Paul Exxon St. Louis Margaret O Mr. Lawrence	10/15/90	209.3	196.4	330.6	269.8	351.5	295.6	-	-	-	
		201.8	180.2	280.1	235.8	333.0	278.8	-	-	-	
		233.5	184.1	315.4	283.7	380.1	286.5	-	-	-	
		287.2	257.2	316.5	285.0	351.6	297.8	-	-	-	
		-	-	-	-	-	-	-	-	-	
A. L. Smith Ste. Genevieve	10/16/90	189.0	172.4	231.0	211.0	561.7	311.1	-	-	-	
		234.5	213.5	-	-	327.8	285.3	421.7	346.7	454.2	
Nicole Brent Frank H. Peavey	10/17/90	181.4	184.0	230.3	196.4	-	-	-	-	-	
		204.0	204.2	236.0	212.0	-	-	-	-	-	

Kampsville Site, Trip 1

2 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2	Station d3
Mr. Aldo Floyd Blaske	10/12/90	100.5	98.1	186.5	158.5	230.0	-	-	-	-
		109.6	103.2	206.5	157.5	197.4	-	-	-	-
Luke Burton Sugarland William C. Norman Frank H. Peavey Conti-Karla	10/13/90	136.6	130.7	217.7	198.1	284.7	237.4	-	-	-
		218.9	174.6	254.1	205.8	307.1	182.3	-	-	-
		172.1	155.1	258.8	239.2	314.4	262.9	-	-	-
		149.1	141.3	-	-	370.2	234.9	-	-	-
		239.9	180.2	-	-	536.5	249.6	-	-	-
Mr. Paul Rambler Mr. Lawrence Mallard Charles Lehman Nicholas Duncan	10/14/90	198.1	188.7	296.2	273.9	-	-	-	-	-
		271.3	264.6	337.5	368.4	-	-	-	-	-
		193.8	196.0	303.4	263.9	-	-	-	-	-
		227.2	208.6	292.8	259.6	-	-	-	-	-
		217.7	206.3	319.9	271.8	-	-	-	-	-
Ardyce Randall Mr. Paul Exxon St. Louis Margaret O Mr. Lawrence	10/15/90	208.1	195.0	328.5	269.7	347.8	294.9	-	-	-
		204.6	183.3	280.6	240.7	334.1	279.3	-	-	-
		237.3	182.3	315.7	284.0	385.2	286.1	-	-	-
		290.9	253.2	316.8	285.4	361.3	287.4	-	-	-
		-	-	-	-	-	-	-	-	-
A. L. Smith Ste. Genevieve	10/16/90	166.9	168.3	231.2	210.9	422.3	332.7	-	-	-
		234.9	214.9	-	-	325.5	286.6	422.5	345.2	456.4
Nicole Brent Frank H. Peavey	10/17/90	180.8	183.2	231.9	197.4	-	-	-	-	-
		200.7	210.6	251.5	213.8	-	-	-	-	-

Kampsville Site, Trip 1

Peak Suspended Sediment Concentrations

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2	Station d3
Mr. Aldo Floyd Blaske	10/12/90	106.3	101.4	349.9	161.9	230.0	-	-	-	-
		157.1	144.8	248.3	186.8	253.2	-	-	-	-
Luke Burton Sugarland William C. Norman Frank H. Peavey Conti-Karla	10/13/90	245.8	193.1	256.9	210.1	313.3	242.5	-	-	-
		285.8	257.0	287.8	229.3	319.5	251.4	-	-	-
		188.9	155.4	276.3	242.1	332.9	264.2	-	-	-
		213.6	167.9	-	-	454.7	246.0	-	-	-
		286.3	267.3	-	-	551.1	279.4	-	-	-
Mr. Paul Rambler Mr. Lawrence Mallard Charles Lehman Nicholas Duncan	10/14/90	201.0	188.7	306.4	273.9	-	-	-	-	-
		277.7	269.2	341.1	374.5	-	-	-	-	-
		356.8	275.7	348.3	362.9	-	-	-	-	-
		276.9	226.7	320.4	274.5	-	-	-	-	-
		379.4	275.7	443.8	305.2	-	-	-	-	-
Ardyce Randall Mr. Paul Exxon St. Louis Margaret O Mr. Lawrence	10/15/90	208.5	195.5	329.2	269.7	349.0	295.1	-	-	-
		209.2	188.5	281.4	248.8	336.1	280.0	-	-	-
		379.1	274.0	316.2	284.7	448.1	305.4	-	-	-
		310.6	257.5	317.2	286.0	373.4	318.8	-	-	-
		-	-	-	-	-	-	-	-	-
A. L. Smith Ste. Genevieve	10/16/90	174.5	169.7	231.7	210.9	563.2	332.7	-	-	-
		261.3	229.6	-	-	328.3	287.1	477.8	345.7	529.5
Nicole Brent Frank H. Peavey	10/17/90	223.1	231.5	252.2	208.4	-	-	-	-	-
		229.5	236.5	252.2	215.1	-	-	-	-	-

Kampsville Site, Trip 1

2 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2	Station d3
Mr. Aldo Floyd Blaske	10/12/90	103.9	95.6	173.7	145.0	191.8	-	-	-	-
		153.1	142.3	222.8	184.5	253.2	-	-	-	-
Luke Burton	10/13/90	218.9	174.6	254.1	205.8	307.1	182.3	-	-	-
Sugarland		270.0	239.7	269.5	229.3	302.8	251.4	-	-	-
William C. Norman		177.5	149.7	273.3	222.2	322.3	251.8	-	-	-
Frank H. Peavey		199.2	162.3	-	-	336.9	239.2	-	-	-
Conti-Karla		263.1	245.0	-	-	450.3	279.4	-	-	-
Mr. Paul	10/14/90	193.2	182.9	282.1	255.4	-	-	-	-	-
Rambler		232.8	232.8	321.2	274.5	-	-	-	-	-
Mr. Lawrence		306.6	264.5	348.3	316.7	-	-	-	-	-
Mallard		262.8	226.7	312.3	270.8	-	-	-	-	-
Charles Lehman		379.4	257.1	443.8	292.1	-	-	-	-	-
Nicholas Duncan		-	-	-	-	-	-	-	-	-
Ardyce Randall	10/15/90	206.6	193.1	325.7	269.6	342.8	294.0	-	-	-
Mr. Paul		208.3	187.5	281.2	247.2	335.7	279.8	-	-	-
Exxon St. Louis		315.1	261.8	316.1	284.5	448.1	298.7	-	-	-
Margaret O		276.2	252.2	317.2	285.9	369.8	315.4	-	-	-
Mr. Lawrence		-	-	-	-	-	-	-	-	-
A. L. Smith	10/16/90	165.7	160.7	231.6	210.8	351.6	226.3	-	-	-
Ste. Genevieve		261.3	226.9	-	-	320.6	283.3	477.8	343.3	529.5
Nicole Brent	10/17/90	198.2	219.2	226.3	204.7	-	-	-	-	-
Frank H. Peavey		223.7	224.7	250.6	213.3	-	-	-	-	-

Kampsville Site, Trip 1

5 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2
Mr. Aldo	10/12/90	105.2	100.6	179.8	157.3	208.0	-	-	-
Floyd Blaske		139.4	120.8	205.0	176.2	217.8	-	-	-
Luke Burton	10/13/90	285.8	225.6	287.8	221.9	319.5	247.2	-	-
Sugarland		354.4	279.1	226.6	212.7	279.6	243.4	-	-
William C. Norman		194.0	170.4	285.0	257.9	346.4	264.0	-	-
Frank H. Peavey		177.4	170.3	-	-	391.7	244.7	-	-
Conti-Karla		252.8	210.9	-	-	409.0	265.7	-	-
Mr. Paul	10/14/90	196.5	173.6	293.7	260.0	-	-	-	-
Rambler		242.6	241.3	338.7	307.5	-	-	-	-
Mr. Lawrence		301.5	299.8	305.0	300.7	-	-	-	-
Mallard		255.1	222.8	325.5	273.1	-	-	-	-
Charles Lehman		294.1	280.2	312.7	287.8	-	-	-	-
Nicholas Duncan		-	-	-	-	-	-	-	-
Ardyce Randall	10/15/90	205.4	191.7	323.6	269.5	339.1	293.3	-	-
Mr. Paul		211.1	190.6	281.7	252.1	336.8	280.2	-	-
Exxon St. Louis		285.0	252.6	316.4	284.9	355.5	304.0	-	-
Margaret O		252.0	234.6	317.4	286.3	361.2	324.9	-	-
Mr. Lawrence		-	-	-	-	-	-	-	-
A. L. Smith	10/16/90	175.6	163.2	231.9	210.7	373.2	204.2	-	-
Ste. Genevieve		238.4	214.5	-	-	323.4	279.5	409.2	341.8
Nicole Brent	10/17/90	342.9	213.0	234.3	202.3	-	-	-	-
Frank H. Peavey		236.8	241.4	251.8	222.3	-	-	-	-
									445.7

Kampsville Site, Trip 1

30 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2	Station d3
Mr. Aldo Floyd Blaske	10/12/90	134.0	128.5	214.2	224.7	229.8	-	-	-	-
		124.6	117.5	194.9	169.0	226.9	-	-	-	-
Luke Burton Sugarland William C. Norman Frank H. Peavey Conti-Karla	10/13/90	302.0	201.0	260.0	225.1	297.5	248.4	-	-	-
		348.1	270.1	256.1	220.5	289.1	234.5	-	-	-
		191.5	193.3	270.3	294.7	398.4	321.4	-	-	-
		268.4	241.5	-	-	309.6	247.4	-	-	-
		256.5	211.7	-	-	381.7	294.0	-	-	-
Mr. Paul Rambler Mr. Lawrence Mallard Charles Lehman Nicholas Duncan	10/14/90	305.9	290.0	359.1	410.7	-	-	-	-	-
		217.3	180.3	304.5	765.8	-	-	-	-	-
		285.9	252.5	311.5	270.8	-	-	-	-	-
		230.0	208.1	302.2	269.3	-	-	-	-	-
		310.8	291.0	355.9	292.4	-	-	-	-	-
		-	-	-	-	-	-	-	-	-
Ardyce Randall Mr. Paul Exxon St. Louis Margaret O Mr. Lawrence	10/15/90	195.4	181.8	306.1	260.7	328.2	279.9	-	-	-
		221.2	202.7	290.0	269.3	362.0	281.3	-	-	-
		294.5	259.4	318.8	288.0	474.6	365.7	-	-	-
		272.6	234.4	319.9	289.4	419.0	343.8	-	-	-
		-	-	-	-	-	-	-	-	-
A. L. Smith Ste. Genevieve	10/16/90	255.4	240.3	234.1	209.7	271.9	238.7	-	-	-
		248.5	231.2	-	-	330.5	271.5	445.1	329.7	472.7
Nicole Brent Frank H. Peavey	10/17/90	208.2	210.0	238.4	209.4	-	-	-	-	-
		205.9	213.0	263.1	243.9	-	-	-	-	-

Kampsville Site, Trip 1

60 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2
Mr. Aldo Floyd Blaske	10/12/90	116.7 124.3	111.4 454.0	189.0 187.6	174.2 172.4	220.9 229.1	- -	- -	- -
Luke Burton Sugarland William C. Norman Frank H. Peavey Conti-Karla	10/13/90	189.1 171.9 190.5 188.2 222.2	174.3 157.1 181.4 174.8 200.0	257.4 256.1 260.1 - -	217.8 219.0 233.7 - -	317.3 320.1 304.7 536.1 397.9	252.1 254.4 251.1 260.4 282.6	- - - - -	- - - - -
Mr. Paul Rambler Mr. Lawrence Mallard Charles Lehman Nicholas Duncan	10/14/90	228.8 348.6 235.2 223.7 260.1 -	227.7 321.5 225.2 212.4 241.9 -	312.5 305.2 293.6 338.2 348.8 -	282.6 274.5 273.5 274.2 312.3 -	- - - - - -	- - - - - -	- - - - - -	- - - - - -
Ardyce Randall Mr. Paul Exxon St. Louis Margaret O Mr. Lawrence	10/15/90	204.0 206.3 233.9 261.7 -	188.1 189.1 225.6 253.6 -	292.8 305.5 321.7 322.8 -	268.0 252.1 291.8 293.1 -	391.9 398.0 372.3 374.6 -	281.9 278.4 383.0 293.7 -	- - - - -	- - - - -
A. L. Smith Ste. Genevieve	10/16/90	185.2 249.4	193.7 221.4	236.8 -	208.6 -	275.6 321.7	236.5 284.6	- 406.0	- 306.4
Nicole Brent Frank H. Peavey	10/17/90	236.5 200.9	247.2 203.1	249.8 257.3	221.3 231.2	- -	- -	- -	- -

Kampsville Site, Trip 1

90 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L									
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2	Station d3	
Mr. Aldo	10/12/90	113.7	110.1	196.0	177.9	237.8	-	-	-	-	
Floyd Blaske		116.1	109.7	203.2	182.9	236.5	-	-	-	-	
Luke Burton	10/13/90	213.6	184.4	275.2	249.0	334.2	264.2	-	-	-	
Sugarland		223.6	203.4	279.9	249.3	321.3	260.9	-	-	-	
William C. Norman		178.7	154.6	233.7	316.2	295.3	241.3	-	-	-	
Frank H. Peavey		268.6	224.9	-	-	378.3	286.9	-	-	-	
Conti-Karla		-	-	-	-	-	-	-	-	-	
Mr. Paul	10/14/90	301.5	299.8	305.0	300.7	-	-	-	-	-	
Rambler		276.9	213.3	320.4	264.7	-	-	-	-	-	
Mr. Lawrence		218.3	199.0	391.6	262.7	-	-	-	-	-	
Mallard		301.9	281.4	357.1	296.4	-	-	-	-	-	
Charles Lehman		-	-	348.4	317.0	-	-	-	-	-	
Nicholas Duncan		-	-	-	-	-	-	-	-	-	
Ardyce Randall	10/15/90	199.7	182.3	283.7	259.3	412.0	281.5	-	-	-	
Mr. Paul		203.5	189.9	302.2	279.0	360.1	286.4	-	-	-	
Exxon St. Louis		283.4	274.5	324.6	295.5	413.9	413.2	-	-	-	
Margaret O		303.6	300.7	325.7	296.9	483.7	402.5	-	-	-	
Mr. Lawrence		-	-	-	-	-	-	-	-	-	
A. L. Smith	10/16/90	200.0	176.7	239.5	207.5	284.2	227.8	-	-	-	
Ste. Genevieve		265.5	231.0	-	-	-	-	406.5	-	-	
Nicole Brent	10/17/90	206.5	206.0	256.3	228.0	-	-	-	-	-	
Frank H. Peavey		206.7	205.4	248.6	233.2	-	-	-	-	-	

Kampsville Site, Trip 1

120 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station c1	Station c2	Station d1	Station d2	Station d3
Mr. Aldo	10/12/90	113.5	109.6	213.8	181.2	246.4	-	-	-	-
Floyd Blaske		118.1	125.4	212.7	191.3	251.0	-	-	-	-
Luke Burton	10/13/90	191.5	177.0	260.9	293.4	322.3	262.0	-	-	-
Sugarland		211.5	192.6	261.6	334.5	315.2	251.8	-	-	-
William C. Norman		173.6	162.2	259.7	314.0	303.0	246.3	-	-	-
Frank H. Peavey		230.5	206.4	-	-	416.0	294.7	-	-	-
Conti-Karla		-	-	-	-	-	-	-	-	-
Mr. Paul	10/14/90	249.2	230.0	305.5	268.4	-	-	-	-	-
Rambler		230.0	208.5	303.7	268.0	-	-	-	-	-
Mr. Lawrence		565.4	434.4	333.2	307.7	-	-	-	-	-
Mallard		261.4	244.8	348.4	315.2	-	-	-	-	-
Charles Lehman		-	-	-	-	-	-	-	-	-
Nicholas Duncan		-	-	-	-	-	-	-	-	-
Ardyce Randall	10/15/90	197.5	177.0	280.0	238.0	356.4	278.7	-	-	-
Mr. Paul		194.0	183.8	299.6	270.0	366.3	298.6	-	-	-
Exxon St. Louis		272.7	262.7	327.5	299.3	423.2	336.1	-	-	-
Margaret O		243.8	264.1	327.6	294.9	415.7	332.7	-	-	-
Mr. Lawrence		-	-	-	-	-	-	-	-	-
A. L. Smith	10/16/90	196.3	178.3	238.4	212.8	266.9	229.5	-	-	-
Ste. Genevieve		-	-	-	-	-	-	-	-	-
Nicole Brent	10/17/90	202.1	201.6	251.5	224.5	-	-	-	-	-
Frank H. Peavey		-	-	-	-	-	-	-	-	-

APPENDIX XVII.

SUSPENDED SEDIMENT CONCENTRATION DATA
FOR CLARKS FERRY, TRIP 1

Clarks Ferry Site, Trip 1

60 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-	-
Donnie Ray Jr. (1)		-	-	-	-	-	-	-	-
Samantha		-	-	-	-	-	-	-	-
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-	-
Jemco Towing		123.8	122.4	147.5	122.4	-	174.0	161.3	156.1
T.S. Kunsmann		-	-	-	-	-	-	-	-
Dell Butcher (1)		-	-	-	-	-	-	-	-
Pearl B.	5/19/91	-	150.7	161.1	158.6	153.6	204.2	194.5	192.5
Conti-Afton		166.7	-	-	-	-	-	197.7	-
Jack D. Wofford		159.1	155.9	173.4	172.6	171.8	209.8	207.4	202.1
Donnie Ray Jr. (2)	5/20/91	-	-	156.4	-	-	173.5	-	-
Sunflower (1)		-	-	-	-	-	-	-	-
American Beauty (1)		-	-	171.9	-	-	160.1	-	-
Sierra Dawn	5/21/91	-	-	-	-	-	-	-	-
Cooperative Vanguard		-	-	-	-	-	-	-	-
Cindy J. Erickson		-	-	-	-	-	-	-	-
Frank H. Peavy		-	-	-	-	-	-	-	-
Helen M. Clements		-	-	-	-	-	-	-	-
Sunflower (2)		-	-	-	-	-	-	-	-
Dell Butcher (2)		-	-	166.1	-	-	-	-	-
Hornet		-	-	-	-	-	-	-	-
Volunteer State		-	-	127.0	-	-	129.0	-	-

Clarks Ferry Site, Trip 1

30 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-	-
Donnie Ray Jr. (1)		-	-	-	-	-	-	-	-
Samantha		-	-	-	-	-	-	-	-
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-	-
Jemco Towing		148.8	145.9	161.1	144.8	-	176.9	164.9	158.9
T.S. Kunsmann		-	-	-	-	-	-	-	-
Dell Butcher (1)		-	-	-	-	-	-	-	-
Pearl B.	5/19/91	-	147.3	164.4	159.3	154.7	204.5	192.5	193.4
Conti-Afton		145.0	142.3	163.0	157.6	158.8	194.3	189.0	190.5
Jack D. Wofford		167.2	160.1	168.0	165.9	166.0	213.0	207.7	222.5
Donnie Ray Jr. (2)	5/20/91	-	-	148.9	-	-	174.6	-	-
Sunflower (1)		-	-	157.3	-	-	-	-	-
American Beauty (1)		-	-	183.4	-	-	175.6	-	-
Sierra Dawn	5/21/91	-	-	-	-	-	-	-	-
Cooperative Vanguard		-	-	-	-	-	-	-	-
Cindy J. Erickson		-	-	-	-	-	-	-	-
Frank H. Peavy		-	-	-	-	-	-	-	-
Helen M. Clements		-	-	-	-	-	-	-	-
Sunflower (2)		-	-	-	-	-	-	-	-
Dell Butcher (2)		-	-	167.9	-	-	149.6	-	-
Hornet		-	-	137.1	-	-	138.4	-	-
Volunteer State		-	-	123.6	-	-	127.0	-	-

Clarks Ferry Site, Trip 1

10 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-	-
Donnie Ray Jr. (1)		-	-	-	-	-	-	-	-
Samantha		-	-	-	-	-	-	-	-
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-	-
Jemco Towing		170.1	157.9	180.8	164.3	-	185.9	188.9	249.6
T.S. Kunsmann		-	-	-	-	-	-	-	-
Dell Butcher (1)		-	-	-	-	-	-	-	-
Pearl B.	5/19/91	-	140.4	157.9	153.3	152.3	193.5	182.0	188.3
Conti-Afton		150.2	142.0	163.0	159.5	161.0	202.3	199.3	200.3
Jack D. Wofford		160.2	158.1	174.1	178.5	180.4	217.2	215.9	214.8
Donnie Ray Jr. (2)	5/20/91	-	-	150.8	-	-	170.4	-	-
Sunflower (1)		-	-	185.6	-	-	189.6	-	-
American Beauty (1)		-	-	195.0	-	-	172.4	-	-
Sierra Dawn	5/21/91	-	-	142.0	-	-	140.9	-	-
Cooperative Vanguard		-	-	143.1	-	-	136.5	-	-
Cindy J. Erickson		-	-	-	-	-	-	-	-
Frank H. Peavy		-	-	-	-	-	-	-	-
Helen M. Clements		-	-	-	-	-	-	-	-
Sunflower (2)		-	-	-	-	-	-	-	-
Dell Butcher (2)		-	-	171.9	-	-	141.8	-	-
Hornet		-	-	132.5	-	-	131.8	-	-
Volunteer State		-	-	120.9	-	-	126.5	-	-

Clarks Ferry Site, Trip 1

5 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-	-	
Donnie Ray Jr. (1)		-	-	-	-	-	-	-	-	
Samantha		-	-	-	-	-	-	-	-	
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-	-	
Jemco Towing		176.9	160.6	185.7	169.2	-	188.1	194.8	272.2	
T.S. Kunsmann		-	-	-	-	-	-	-	-	
Dell Butcher (1)		-	-	-	-	-	-	-	-	
Pearl B.	5/19/91	-	139.0	156.2	154.1	151.3	191.3	181.1	183.1	
Conti-Afton		153.8	140.6	163.6	155.4	157.2	196.4	196.3	199.8	
Jack D. Wofford		158.4	157.6	175.6	181.6	184.0	218.3	217.9	212.9	
Donnie Ray Jr. (2)	5/20/91	-	-	151.3	-	-	169.4	-	-	
Sunflower (1)		-	-	183.8	-	-	185.5	-	-	
American Beauty (1)		-	-	200.0	-	-	173.1	-	-	
Sierra Dawn	5/21/91	-	-	135.8	-	-	139.7	-	-	
Cooperative Vanguard		-	-	138.8	-	-	137.7	-	-	
Cindy J. Erickson		-	-	-	-	-	-	-	-	
Frank H. Peavy		-	-	-	-	-	-	-	-	
Helen M. Clements		-	-	-	-	-	-	-	-	
Sunflower (2)		-	-	-	-	-	-	-	-	
Dell Butcher (2)		-	-	172.9	-	-	139.9	-	-	
Hornet		-	-	130.1	-	-	132.4	-	-	
Volunteer State		-	-	114.8	-	-	128.6	-	-	

Clarks Ferry Site, Trip 1

2 Minutes Prior to Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L						
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-
Donnie Ray Jr. (1)		-	-	-	-	-	-	-
Samantha		-	-	-	-	-	-	-
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-
Jemco Towing		175.2	157.3	183.6	172.1	-	192.3	187.5
T.S. Kunsmann		-	-	-	-	-	-	-
Dell Butcher (1)		-	-	-	-	-	-	-
Pearl B.	5/19/91	-	139.1	156.8	159.8	150.5	192.0	184.6
Conti-Afton		156.0	139.7	164.0	152.9	154.9	192.8	194.5
Jack D. Wofford		157.3	157.3	180.1	183.5	186.2	218.9	209.4
Donnie Ray Jr. (2)	5/20/91	-	-	151.5	-	-	168.7	-
Sunflower (1)		-	-	183.7	-	-	181.9	-
American Beauty (1)		-	-	203.0	-	-	173.6	-
Sierra Dawn	5/21/91	-	-	132.0	-	-	138.9	-
Cooperative Vanguard		-	-	147.0	-	-	142.8	-
Cindy J. Erickson		-	-	-	-	-	-	-
Frank H. Peavy		-	-	-	-	-	-	-
Helen M. Clements		-	-	-	-	-	-	-
Sunflower (2)		-	-	-	-	-	-	-
Dell Butcher (2)		-	-	159.0	-	-	139.8	-
Hornet		-	-	134.6	-	-	131.7	-
Volunteer State		-	-	116.0	-	-	130.9	-

Clarks Ferry Site, Trip 1

Peak Suspended Sediment Concentrations

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-	-
Donnie Ray Jr. (1)		-	-	-	-	-	-	-	-
Samantha		-	-	-	-	-	-	-	-
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-	-
Jemco Towing		179.1	163.0	187.6	174.2	-	193.9	196.0	294.9
T.S. Kunsmann		-	-	-	-	-	-	-	-
Dell Butcher (1)		-	-	-	-	-	-	-	-
Pearl B.	5/19/91	-	152.4	174.3	171.4	169.4	198.6	198.0	189.8
Conti-Afton		156.0	161.2	176.4	171.3	166.3	210.0	201.9	200.4
Jack D. Wofford		179.2	170.2	190.2	184.7	187.6	220.0	221.7	224.0
Donnie Ray Jr. (2)	5/20/91	-	-	167.3	-	-	186.4	-	-
Sunflower (1)		-	-	192.9	-	-	189.6	-	-
American Beauty (1)		-	-	211.1	-	-	185.9	-	-
Sierra Dawn	5/21/91	-	-	142.0	-	-	140.9	-	-
Cooperative Vanguard		-	-	200.8	-	-	142.8	-	-
Cindy J. Erickson		-	-	-	-	-	-	-	-
Frank H. Peavy		-	-	-	-	-	-	-	-
Helen M. Clements		-	-	-	-	-	-	-	-
Sunflower (2)		-	-	-	-	-	-	-	-
Dell Butcher (2)		-	-	172.9	-	-	145.4	-	-
Hornet		-	-	139.3	-	-	138.0	-	-
Volunteer State		-	-	209.6	-	-	144.4	-	-

Clarks Ferry Site, Trip 1

Average Suspended Sediment Concentrations

Tow name	Date	Average Suspended Sediment Concentration during Event, mg/L						
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-
Donnie Ray Jr. (1)		-	-	-	-	-	-	-
Samantha		-	-	-	-	-	-	-
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-
Jenco Towing		167.4	153.1	181.6	-	-	179.0	227.1
T.S. Kunsmann		-	-	-	-	-	-	-
Dell Butcher (1)		-	-	-	-	-	-	-
Pearl B.	5/19/91	-	-	-	-	-	-	-
Conti-Afton		150.8	-	164.2	-	-	-	199.4
Jack D. Wofford		-	-	-	-	-	219.4	216.7
Donnie Ray Jr. (2)	5/20/91	-	-	-	-	-	-	-
Sunflower (1)		-	-	183.5	-	-	179.6	-
American Beauty (1)		-	-	-	-	-	-	-
Sierra Dawn	5/21/91	-	-	137.6	-	-	138.3	-
Cooperative Vanguard		-	-	-	-	-	137.5	-
Cindy J. Erickson		-	-	-	-	-	-	-
Frank H. Peavy		-	-	-	-	-	-	-
Helen M. Clements		-	-	-	-	-	-	-
Sunflower (2)		-	-	-	-	-	-	-
Dell Butcher (2)		-	-	148.3	-	-	-	-
Hornet	-	-	-	-	-	-	-	-
Volunteer State	-	-	-	-	-	-	-	-

Clarks Ferry Site, Trip 1

2 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-	-	
Donnie Ray Jr. (1)		-	-	-	-	-	-	-	-	
Samantha		-	-	-	-	-	-	-	-	
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-	-	
Jemco Towing		159.6	163.0	173.7	174.1	-	192.3	180.3	267.8	
T.S. Kunsmann		-	-	-	-	-	-	-	-	
Dell Butcher (1)		-	-	-	-	-	-	-	-	
Pearl B.	5/19/91	-	142.0	161.2	158.1	149.8	189.0	187.1	183.9	
Conti-Afton		154.9	139.0	165.3	156.1	157.5	194.0	196.7	196.8	
Jack D. Wofford		155.0	159.4	183.4	181.7	176.2	217.8	212.3	205.2	
Donnie Ray Jr. (2)	5/20/91	-	-	151.6	-	-	186.4	-	-	
Sunflower (1)		-	-	182.6	-	-	178.1	-	-	
American Beauty (1)		-	-	190.0	-	-	177.1	-	-	
Sierra Dawn	5/21/91	-	-	139.7	-	-	128.8	-	-	
Cooperative Vanguard		-	-	144.9	-	-	140.2	-	-	
Cindy J. Erickson		-	-	-	-	-	-	-	-	
Frank H. Peavy		-	-	-	-	-	-	-	-	
Helen M. Clements		-	-	-	-	-	-	-	-	
Sunflower (2)		-	-	-	-	-	-	-	-	
Dell Butcher (2)		-	-	150.9	-	-	145.4	-	-	
Hornet		-	-	132.3	-	-	137.6	-	-	
Volunteer State		-	-	126.4	-	-	138.6	-	-	

Clarks Ferry Site, Trip 1

5 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentrations, mg/L							
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-	-
Donnie Ray Jr. (1)		-	-	-	-	-	-	-	-
Samantha		-	-	-	-	-	-	-	-
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-	-
Jemco Towing		151.2	145.1	167.6	171.9	-	192.1	179.5	227.1
T.S. Kunsmann		-	-	-	-	-	-	-	-
Dell Butcher (1)		-	-	-	-	-	-	-	-
Pearl B.	5/19/91	-	145.2	159.6	162.2	154.8	194.7	194.4	184.6
Conti-Afton		167.3	153.1	166.4	163.9	164.0	203.5	199.4	195.5
Jack D. Wofford		173.0	163.7	187.2	182.3	172.7	215.5	203.6	204.2
Donnie Ray Jr. (2)	5/20/91	-	-	161.0	-	-	180.1	-	-
Sunflower (1)		-	-	181.3	-	-	175.9	-	-
American Beauty (1)		-	-	199.2	-	-	176.8	-	-
Sierra Dawn	5/21/91	-	-	139.9	-	-	135.1	-	-
Cooperative Vanguard		-	-	140.0	-	-	134.9	-	-
Cindy J. Erickson		-	-	-	-	-	-	-	-
Frank H. Peavy		-	-	-	-	-	-	-	-
Helen M. Clements		-	-	-	-	-	-	-	-
Sunflower (2)		-	-	-	-	-	-	-	-
Dell Butcher (2)		-	-	150.1	-	-	139.9	-	-
Hornet		-	-	134.7	-	-	136.7	-	-
Volunteer State		-	-	127.1	-	-	139.7	-	-

Clarks Ferry Site, Trip 1

30 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-	-	
Donnie Ray Jr. (1)		-	-	-	-	-	-	-	-	
Samantha		-	-	-	-	-	-	-	-	
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-	-	
Jemco Towing		139.3	136.6	162.4	162.3	-	185.4	173.8	270.3	
T.S. Kunsmann		-	-	-	-	-	-	-	-	
Dell Butcher (1)		-	-	-	-	-	-	-	-	
Pearl B.	5/19/91	-	151.8	170.8	175.0	165.8	196.0	198.6	195.5	
Conti-Afton		155.4	151.8	180.6	173.0	171.8	201.1	199.8	195.9	
Jack D. Wofford		183.2	159.8	194.2	179.7	181.9	220.1	208.6	209.6	
Donnie Ray Jr. (2)	5/20/91	-	-	179.2	-	-	-	-	-	
Sunflower (1)		-	-	174.6	-	-	178.1	-	-	
American Beauty (1)		-	-	201.7	-	-	183.1	-	-	
Sierra Dawn	5/21/91	-	-	-	-	-	-	-	-	
Cooperative Vanguard		-	-	135.8	-	-	139.4	-	-	
Cindy J. Erickson		-	-	-	-	-	-	-	-	
Frank H. Peavy		-	-	-	-	-	-	-	-	
Helen M. Clements		-	-	-	-	-	-	-	-	
Sunflower (2)		-	-	-	-	-	-	-	-	
Dell Butcher (2)		-	-	141.1	-	-	140.2	-	-	
Hornet		-	-	136.3	-	-	132.8	-	-	
Volunteer State		-	-	166.7	-	-	154.3	-	-	

Clarks Ferry Site, Trip 1

60 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L						
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2 Station c3
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-
Donnie Ray Jr. (1)		-	-	-	-	-	-	-
Samantha		-	-	-	-	-	-	-
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-
Jenco Towing		-	132.3	141.3	-	-	183.0	166.0 208.1
T.S. Kunsmann		-	-	-	-	-	-	-
Dell Butcher (1)		-	-	-	-	-	-	-
Pearl B.	5/19/91	-	143.1	163.0	156.9	157.8	-	186.1
Conti-Afton		160.1	156.2	173.6	170.9	171.7	202.1	194.6
Jack D. Wofford		165.0	160.2	181.9	174.4	168.4	200.7	201.7 195.6
Donnie Ray Jr. (2)	5/20/91	-	-	-	-	-	-	-
Sunflower (1)		-	-	168.8	-	-	131.9	-
American Beauty (1)		-	-	186.2	-	-	176.1	-
Sierra Dawn	5/21/91	-	-	-	-	-	-	-
Cooperative Vanguard		-	-	151.4	-	-	142.5	-
Cindy J. Erickson		-	-	-	-	-	-	-
Frank H. Peavy		-	-	-	-	-	-	-
Helen M. Clements		-	-	-	-	-	-	-
Sunflower (2)		-	-	-	-	-	-	-
Dell Butcher (2)		-	-	133.3	-	-	-	-
Hornet		-	-	143.5	-	-	130.6	-
Volunteer State		-	-	149.5	-	-	141.2	-

Clarks Ferry Site, Trip 1

90 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L								
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1	Station c2	Station c3	
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-	-	-	
Donnie Ray Jr. (1)		-	-	-	-	-	-	-	-	
Samantha		-	-	-	-	-	-	-	-	
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-	-	-	
Jemco Towing		-	-	-	-	-	-	-	-	
T.S. Kunsmann		-	-	-	-	-	-	-	-	
Dell Butcher (1)		-	-	-	-	-	-	-	-	
Pearl B.	5/19/91	-	-	-	155.4	-	-	-	-	
Conti-Afton		161.8	151.0	168.6	166.1	172.1	205.0	185.8	201.5	
Jack D. Wofford		158.7	154.7	190.3	176.9	179.5	210.2	297.4	199.0	
Donnie Ray Jr. (2)	5/20/91	-	-	-	-	-	-	-	-	
Sunflower (1)		-	-	163.3	-	-	161.9	-	-	
American Beauty (1)		-	-	173.9	-	-	167.5	-	-	
Sierra Dawn	5/21/91	-	-	-	-	-	-	-	-	
Cooperative Vanguard		-	-	165.9	-	-	149.4	-	-	
Cindy J. Erickson		-	-	-	-	-	-	-	-	
Frank H. Peavy		-	-	-	-	-	-	-	-	
Helen M. Clements		-	-	-	-	-	-	-	-	
Sunflower (2)		-	-	-	-	-	-	-	-	
Dell Butcher (2)	Hornet	-	-	-	-	-	-	-	-	
Volunteer State		-	-	127.4	-	-	129.2	-	-	
		-	-	-	-	-	-	-	-	

Clarks Ferry Site, Trip 1

120 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L					
		Station a1	Station a2	Station b1	Station b2	Station b3	Station c1 Station c2 Station c3
C.W. Rushing (1)	5/16/91	-	-	-	-	-	-
Donnie Ray Jr. (1)		-	-	-	-	-	-
Samantha		-	-	-	-	-	-
C.W. Rushing (2)	5/17/91	-	-	-	-	-	-
Jemco Towing		-	-	-	-	-	-
T.S. Kunsmann		-	-	-	-	-	-
Dell Butcher (1)		-	-	-	-	-	-
Pearl B.	5/19/91	-	-	-	-	-	-
Conti-Afton		157.5	154.4	171.0	167.1	168.8	206.1 210.3 204.9
Jack D. Wofford		-	170.1	179.3	-	178.6	- 198.8 194.8
Donnie Ray Jr. (2)	5/20/91	-	-	-	-	-	-
Sunflower (1)		-	-	160.4	-	-	135.6 - -
American Beauty (1)		-	-	-	-	-	-
Sierra Dawn	5/21/91	-	-	-	-	-	-
Cooperative Vanguard		-	-	166.1	-	-	149.6 - -
Cindy J. Erickson		-	-	-	-	-	-
Frank H. Peavy		-	-	-	-	-	-
Helen M. Clements		-	-	-	-	-	-
Sunflower (2)		-	-	-	-	-	-
Dell Butcher (2)		-	-	-	-	-	-
Hornet		-	-	125.5	-	-	128.3 - -
Volunteer State		-	-	-	-	-	-

APPENDIX XVIII.

SUSPENDED SEDIMENT CONCENTRATION DATA
FOR GOOSE ISLAND, TRIP 2

Goose Island Site, Trip 2

60 Minutes before Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		-	-	-	-	-	-	-	-
Helen M. Clements		130.0	117.6	105.5	119.0	124.6	-	-	-
Elizabeth Ann		115.2	108.2	110.5	119.5	127.6	-	-	-
Frank T. Heffelfinger	7/19/91	89.3	93.4	85.5	114.9	73.2	-	-	-
Queen City		102.3	94.6	80.6	68.9	58.6	-	-	-
Helen M. Clements		104.3	71.0	121.2	71.1	66.9	-	-	-
Frank T. Heffelfinger		101.4	89.0	129.3	75.9	73.2	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State		-	-	-	-	-	-	-	-
No name		-	-	-	-	-	-	-	-
Night 1		-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	123.5	133.5	-	-	-	-	-
Lil Charley		-	124.7	131.1	-	-	-	-	-
C.W. Rushing		-	164.7	184.3	-	-	-	-	-
Conti-Nan		-	121.4	121.5	-	-	-	135.9	140.0
Mary L		-	117.1	119.9	-	-	-	109.0	138.1
Scarlet Knight	7/21/91	-	126.4	117.4	-	-	-	-	-
Conti-Karla		-	274.5	271.5	-	-	-	88.5	133.7

Goose Island Site, Trip 2

60 Minutes before Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	-	-	-	-	-	-	-
Cooperative Ambassador		-	124.9	103.0	-	-	-	69.4	69.8
Eastern		-	127.4	104.7	-	-	-	68.9	71.1
Sam M. Fleming		-	129.3	106.0	-	-	-	68.6	72.1
Kevin Michael		-	111.7	115.9	-	-	56.6	70.1	69.0
A.M. Thompson	7/23/91	-	74.1	67.6	-	-	63.5	66.7	71.3
Susan Elizabeth		-	72.6	67.9	-	-	63.2	65.9	71.6
Lil Charley		-	72.6	67.9	-	-	63.2	65.9	71.6
Badger		-	150.8	145.9	-	-	64.2	65.8	68.0
Kay D		-	150.5	132.0	-	-	65.2	68.6	68.9
Evey-T		-	104.4	97.6	-	-	60.0	65.4	69.0
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2

30 Minutes before Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		-	-	-	-	-	-	-	-
Helen M. Clements		120.6	109.3	110.0	120.0	126.4	-	-	-
Elizabeth Ann		117.8	95.6	79.5	126.8	126.3	-	-	-
Frank T. Heffelfinger	7/19/91	87.9	109.8	97.0	113.0	78.7	-	-	-
Queen City		77.8	74.9	91.2	70.5	46.6	-	-	-
Helen M. Clements		103.1	71.5	121.1	95.1	74.9	-	-	-
Frank T. Heffelfinger		100.0	74.2	117.9	92.2	76.8	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State		-	-	-	-	-	-	-	-
No name		-	-	-	-	-	-	-	-
Night 1		-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	129.5	132.1	-	-	-	-	-
Lil Charley		-	142.6	140.0	-	-	-	-	-
C.W. Rushing		-	161.2	167.0	-	-	-	-	-
Conti-Nan		-	129.3	132.0	-	-	-	124.6	136.8
Mary L		-	99.0	96.9	-	-	-	111.7	122.1
Scarlet Knight	7/21/91	-	162.7	151.5	-	-	-	-	-
Conti-Karla		-	160.5	144.1	-	-	-	84.2	102.7

Goose Island Site, Trip 2

30 Minutes before Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	-	-	-	-	-	-	-
Cooperative Ambassador		-	119.6	113.2	-	-	-	65.8	71.5
Eastern		-	116.7	114.4	-	-	-	67.2	70.6
Sam M. Fleming		-	114.6	115.2	-	-	-	68.3	70.0
Kevin Michael		-	265.9	183.1	-	-	68.2	67.8	67.3
A.M. Thompson	7/23/91	-	73.4	69.6	-	-	63.9	66.8	71.5
Susan Elizabeth		-	75.1	70.5	-	-	64.5	67.9	71.2
Lil Charley		-	75.1	70.5	-	-	64.5	67.9	71.2
Badger		-	109.0	105.3	-	-	60.5	65.4	69.2
Kay D		-	122.7	128.5	-	-	62.2	65.5	69.7
Evey-T		-	92.5	88.8	-	-	62.2	64.8	68.1
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2

10 Minutes before Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		-	-	-	-	-	-	-	-
Helen M. Clements		100.9	114.5	110.2	116.9	130.3	-	-	-
Elizabeth Ann		113.6	88.5	90.2	87.2	82.8	-	-	-
Frank T. Heffelfinger	7/19/91	76.6	93.0	103.5	111.8	83.4	-	-	-
Queen City		71.9	73.1	74.0	78.7	57.7	-	-	-
Helen M. Clements		90.0	72.8	117.6	82.2	74.0	-	-	-
Frank T. Heffelfinger		98.9	86.7	129.0	71.2	73.5	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State	-	-	-	-	-	-	-	-	-
No name	-	-	-	-	-	-	-	-	-
Night 1	-	-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher	-	145.9	141.9	-	-	-	-	-	-
Lil Charley	-	134.6	146.0	-	-	-	-	-	-
C.W. Rushing	-	145.6	155.5	-	-	-	-	-	-
Conti-Nan	-	131.2	129.1	-	-	-	-	132.4	129.1
Mary L	-	87.1	100.2	-	-	-	-	112.9	118.5
Scarlet Knight	7/21/91	-	141.5	141.4	-	-	-	-	-
Conti-Karla		-	159.4	158.5	-	-	-	85.9	105.5

Goose Island Site, Trip 2

10 Minutes before Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	115.3	96.5	-	-	-	-	-
Cooperative Ambassador		-	116.7	110.6	-	-	61.8	69.9	69.4
Eastern		-	119.6	107.6	-	-	64.7	69.7	69.7
Sam M. Fleming		-	121.7	105.3	-	-	66.9	69.6	69.8
Kevin Michael	7/23/91	-	169.6	144.0	-	-	71.9	68.3	77.6
A.M. Thompson		-	84.8	86.4	-	-	65.9	68.5	71.7
Susan Elizabeth		-	105.0	126.3	-	-	64.7	67.0	74.3
Lil Charley		-	105.0	126.3	-	-	64.7	67.0	74.3
Badger		-	109.3	93.8	-	-	62.1	60.3	69.6
Kay D		-	103.1	82.3	-	-	62.1	58.0	69.7
Evey-T		-	110.6	88.0	-	-	62.6	64.2	69.3
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2
5 Minutes before Barge-Tow Passage

Tow name	Suspended Sediment Concentration, mg/L								
	Date	Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		127.6	133.2	106.1	122.2	143.3	-	-	-
Helen M. Clements		94.9	117.2	110.1	115.8	131.4	-	-	-
Elizabeth Ann		123.9	101.3	90.6	105.5	78.5	-	-	-
Frank T. Heffelfinger	7/19/91	73.8	88.8	105.1	111.5	84.6	-	-	-
Queen City		70.4	72.6	69.7	80.8	60.5	-	-	-
Helen M. Clements		85.0	72.1	117.5	77.3	72.6	-	-	-
Frank T. Heffelfinger		88.4	80.2	116.6	75.3	70.6	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State		-	-	-	-	-	-	-	-
No name		-	-	-	-	-	-	-	-
Night 1		-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	142.4	143.2	-	-	-	-	-
Lil Charley		-	131.1	147.3	-	-	-	-	-
C.W. Rushing		-	141.6	152.6	-	-	-	-	-
Conti-Nan		-	131.6	128.0	-	-	-	134.8	127.0
Mary L		-	84.6	105.3	-	-	-	110.7	117.9
Scarlet Knight	7/21/91	-	148.2	145.7	-	-	-	-	-
Conti-Karla		-	161.4	165.2	-	-	-	86.8	107.4

Goose Island Site, Trip 2

5 Minutes before Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	118.5	98.7	-	-	-	-	-
Cooperative Ambassador		-	120.3	106.8	-	-	65.4	69.7	69.7
Eastern		-	133.7	103.8	-	-	65.6	68.8	70.6
Sam M. Fleming		-	135.0	102.0	-	-	65.9	67.8	69.1
Kevin Michael	7/23/91	-	135.6	137.3	-	-	68.2	69.2	73.8
A.M. Thompson		-	97.9	111.3	-	-	67.0	66.4	73.9
Susan Elizabeth		-	90.7	105.6	-	-	63.3	61.6	69.9
Lil Charley		-	90.7	105.6	-	-	63.3	61.6	69.9
Badger		-	94.7	80.3	-	-	62.1	60.8	69.0
Kay D		-	82.1	77.4	-	-	62.2	65.0	67.9
Evey-T		-	157.6	87.3	-	-	62.0	65.4	74.4
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2

2 Minutes before Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		131.0	131.0	108.2	128.0	148.6	-	-	-
Helen M. Clements		86.0	106.0	94.7	113.0	130.3	-	-	-
Elizabeth Ann		112.4	97.3	86.5	113.7	76.6	-	-	-
Frank T. Heffelfinger	7/19/91	91.8	90.7	85.7	111.4	97.1	-	-	-
Queen City		76.1	76.7	69.0	74.1	60.6	-	-	-
Helen M. Clements		91.2	85.6	117.4	73.2	71.8	-	-	-
Frank T. Heffelfinger		108.7	86.2	123.6	93.8	75.9	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State		-	-	-	-	-	-	-	-
No name		-	-	-	-	-	-	-	-
Night 1		-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	140.3	144.0	-	-	-	-	-
Lil Charley		-	128.9	148.1	-	-	-	-	-
C.W. Rushing		-	139.3	150.9	-	-	-	-	-
Conti-Nan		-	128.1	127.4	-	-	-	134.6	135.3
Mary L		-	109.6	127.2	-	-	-	108.8	109.7
Scarlet Knight	7/21/91	-	152.2	148.3	-	-	-	-	-
Conti-Karla		-	162.7	169.2	-	-	-	87.2	108.6

Goose Island Site, Trip 2

2 Minutes before Barge-Tow Passage (Concluded)

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>							
		<i>Station a1</i>	<i>Station b1</i>	<i>Station b2</i>	<i>Station c1</i>	<i>Station c2</i>	<i>Station d1</i>	<i>Station e1</i>	<i>Station e2</i>
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	120.4	100.0	-	-	-	-	-
Cooperative Ambassador		-	122.4	104.6	-	-	67.6	69.6	69.9
Eastern		-	135.0	102.0	-	-	65.9	67.8	69.1
Sam M. Fleming		-	113.3	105.8	-	-	66.8	69.1	69.4
Kevin Michael		-	125.4	116.5	-	-	68.0	69.0	69.0
A.M. Thompson	7/23/91	-	105.0	126.3	-	-	64.7	67.0	74.3
Susan Elizabeth		-	132.6	88.7	-	-	63.8	66.7	72.6
Lil Charley		-	132.6	88.7	-	-	63.8	66.7	72.6
Badger		-	82.1	77.4	-	-	62.2	65.0	67.9
Kay D		-	113.3	111.7	-	-	62.3	64.5	68.6
Evey-T		-	154.5	91.1	-	-	64.9	65.8	74.5
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2

Peak Suspended Sediment Concentrations

Tow name	Date	Peak Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal	148.3	133.2	113.2	131.8	153.8				
Helen M. Clements	120.0	117.7	110.1	122.8	136.5				
Elizabeth Ann	123.9	101.3	90.6	123.7	79.1				
Frank T. Heffelfinger	7/19/91	104.0	110.0	109.8	124.8	97.1	-	-	-
Queen City	92.8	92.1	88.2	93.3	61.6				
Helen M. Clements	99.4	99.3	129.0	77.3	73.5				
Frank T. Heffelfinger	111.1	104.9	135.6	103.4	79.5				
Cooperative Venture	-	-	-	-	-	-	-	-	-
Volunteer State	-	-	-	-	-	-	-	-	-
No name	-	-	-	-	-	-	-	-	-
Night 1	-	-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	142.4	145.8	-	-	-	-	-
Lil Charley		-	131.1	150.8	-	-	-	-	-
C.W. Rushing		-	150.1	161.6	-	-	-	-	-
Conti-Nan		-	131.7	128.0	-	-	-	135.7	139.3
Mary L		-	147.8	158.5	-	-	-	110.7	122.7
Scarlet Knight	7/21/91	-	161.5	154.4	-	-	-	-	-
Conti-Karla		-	163.1	184.3	-	-	-	91.9	129.3

Goose Island Site, Trip 2

Peak Suspended Sediment Concentrations (Concluded)

Tow name	Date	Peak Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	124.9	103.0	-	-	-	-	-
Cooperative Ambassador		-	145.0	106.8	-	-	67.6	69.7	71.3
Eastern		-	254.2	183.6	-	-	70.3	73.8	71.3
Sam M. Fleming		-	280.0	231.2	-	-	71.6	73.8	70.3
Kevin Michael		-	142.3	150.8	-	-	69.1	77.1	73.8
A.M. Thompson	7/23/91	-	164.7	126.3	-	-	67.4	68.5	74.7
Susan Elizabeth		-	164.7	109.5	-	-	70.0	69.8	72.7
Lil Charley		-	164.7	109.5	-	-	70.0	69.8	72.7
Badger		-	153.0	150.5	-	-	62.4	65.0	69.4
Kay D		-	181.3	174.3	-	-	62.5	65.1	69.8
Evey-T		-	157.6	95.9	-	-	65.9	66.8	78.2
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2

Average Suspended Sediment Concentrations

Tow name	Date	Average Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal	105.8	129.6	109.6	131.8	152.1	-	-	-	-
Helen M. Clements	120.0	108.4	86.8	111.4	124.3	-	-	-	-
Elizabeth Ann	97.9	83.4	84.8	123.7	75.6	-	-	-	-
Frank T. Heffelfinger	7/19/91	87.4	98.3	99.4	111.1	86.8	-	-	-
Queen City	92.8	85.1	72.4	75.5	60.7	-	-	-	-
Helen M. Clements	98.9	86.7	129.0	71.2	73.5	-	-	-	-
Frank T. Heffelfinger	107.3	74.5	135.6	102.2	75.6	-	-	-	-
Cooperative Venture	-	-	-	-	-	-	-	-	-
Volunteer State	-	-	-	-	-	-	-	-	-
No name	-	-	-	-	-	-	-	-	-
Night 1	-	-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3	-	-	-	-	-	-	-	-	-
G.R. Packet	-	-	-	-	-	-	-	-	-
Prairie Dawn	-	-	-	-	-	-	-	-	-
Prosperity	-	-	-	-	-	-	-	-	-
Clyde Butcher	-	138.8	144.5	-	-	-	-	-	-
Lil Charley	-	127.5	148.6	-	-	-	-	-	-
C.W. Rushing	-	131.6	156.0	-	-	-	-	-	-
Conti-Nan	-	120.8	116.7	-	-	-	-	129.7	139.3
Mary L	-	135.1	148.1	-	-	-	-	107.5	115.8
Scarlet Knight	7/21/91	-	154.8	150.0	-	-	-	-	-
Conti-Karla	-	-	160.3	164.4	-	-	-	90.6	108.8

Goose Island Site, Trip 2

Average Suspended Sediment Concentrations (Concluded)

Tow name	Date	Average Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	121.7	100.8	-	-	-	-	-
Cooperative Ambassador		-	145.0	105.8	-	-	63.6	67.9	71.3
Eastern		-	113.6	101.0	-	-	65.7	68.1	69.1
Sam M. Fleming		-	178.0	112.8	-	-	68.4	72.0	70.0
Kevin Michael		-	131.2	117.7	-	-	68.4	68.4	68.3
A.M. Thompson	7/23/91	-	105.4	113.0	-	-	62.2	67.3	72.2
Susan Elizabeth		-	99.4	109.5	-	-	65.0	66.9	72.2
Lil Charley		-	99.4	109.5	-	-	65.0	66.9	72.2
Badger		-	102.9	100.3	-	-	62.3	64.6	68.4
Kay D		-	134.1	134.6	-	-	62.4	64.1	69.1
Evey-T		-	152.6	92.9	-	-	64.4	66.2	75.2
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2

2 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		105.8	128.1	111.1	124.2	152.3	-	-	-
Helen M. Clements		102.6	113.6	97.6	115.7	124.4	-	-	-
Elizabeth Ann		97.6	83.8	84.4	89.5	71.6	-	-	-
Frank T. Heffelfinger	7/19/91	104.0	106.2	108.1	112.0	76.9	-	-	-
Queen City		76.2	83.9	88.2	86.2	61.3	-	-	-
Helen M. Clements		93.8	73.7	118.9	74.0	65.4	-	-	-
Frank T. Heffelfinger		104.8	78.6	131.8	100.0	77.1	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State		-	-	-	-	-	-	-	-
No name		-	-	-	-	-	-	-	-
Night 1		-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	137.4	145.0	-	-	-	-	-
Lil Charley		-	126.1	149.1	-	-	-	-	-
C.W. Rushing		-	140.8	155.4	-	-	-	-	-
Conti-Nan		-	112.7	123.0	-	-	-	127.2	136.8
Mary L		-	139.3	131.7	-	-	-	-	121.6
Scarlet Knight	7/21/91	-	157.5	151.8	-	-	-	-	-
Conti-Karla		-	145.2	135.5	-	-	-	81.5	114.1

Goose Island Site, Trip 2

2 Minutes after Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	123.0	101.7	-	-	-	-	-
Cooperative Ambassador		-	135.0	102.0	-	-	65.9	67.8	69.1
Eastern		-	112.9	109.3	-	-	67.9	70.1	69.7
Sam M. Fleming		-	254.2	183.6	-	-	70.3	71.3	68.6
Kevin Michael	7/23/91	-	142.3	124.7	-	-	67.4	67.4	68.1
A.M. Thompson		-	97.4	103.2	-	-	62.9	63.9	70.3
Susan Elizabeth		-	100.5	93.0	-	-	67.9	66.5	69.6
Lil Charley		-	100.5	93.0	-	-	67.9	66.5	69.6
Badger		-	123.7	123.2	-	-	62.4	64.3	68.9
Kay D		-	153.0	150.5	-	-	62.4	64.5	69.4
Evey-T		-	150.7	94.1	-	-	61.5	66.5	76.5
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2
5 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		108.3	125.9	113.2	121.8	148.0	-	-	-
Helen M. Clements		95.2	106.5	107.1	118.9	136.5	-	-	-
Elizabeth Ann		100.5	90.3	88.3	78.5	78.8	-	-	-
Frank T. Heffelfinger	7/19/91	79.7	88.9	96.4	101.7	72.2	-	-	-
Queen City		84.3	73.3	69.4	92.9	61.6	-	-	-
Helen M. Clements		88.4	80.2	116.6	75.3	70.6	-	-	-
Frank T. Heffelfinger		109.0	104.9	132.6	84.3	77.0	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State		-	-	-	-	-	-	-	-
No name		-	-	-	-	-	-	-	-
Night 1		-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	135.3	145.8	-	-	-	-	-
Lil Charley		-	126.0	150.8	-	-	-	-	-
C.W. Rushing		-	150.1	129.7	-	-	-	-	-
Conti-Nan		-	101.3	104.7	-	-	-	134.9	134.7-
Mary L		-	144.4	131.8	-	-	-	-	119.7
Scarlet Knight	7/21/91	-	161.5	154.4	-	-	-	-	-
Conti-Karla		-	151.1	164.1	-	-	-	89.8	129.3

Goose Island Site, Trip 2

5 Minutes after Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	124.9	103.0	-	-	-	-	-
Cooperative Ambassador		-	113.3	105.8	-	-	66.8	69.1	69.4
Eastern		-	254.2	183.6	-	-	70.3	71.3	68.6
Sam M. Fleming		-	280.0	207.2	-	-	70.3	68.1	65.9
Kevin Michael		-	123.7	131.8	-	-	66.8	77.1	69.2
A.M. Thompson	7/23/91	-	164.7	98.3	-	-	63.5	63.6	72.4
Susan Elizabeth		-	101.6	90.3	-	-	61.9	64.9	72.2
Lil Charley		-	101.6	90.3	-	-	61.9	64.9	72.2
Badger		-	153.0	150.5	-	-	62.4	64.5	69.4
Kay D		-	181.3	174.3	-	-	62.5	65.1	69.8
Evey-T		-	148.0	95.9	-	-	59.5	66.5	78.2
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2
30 Minutes after Barge-Tow Passage

<i>Tow name</i>	<i>Date</i>	<i>Suspended Sediment Concentration, mg/L</i>							
		<i>Station a1</i>	<i>Station b1</i>	<i>Station b2</i>	<i>Station c1</i>	<i>Station c2</i>	<i>Station d1</i>	<i>Station e1</i>	<i>Station e2</i>
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		122.0	125.3	116.3	113.1	133.8	-	-	-
Helen M. Clements		101.1	105.3	90.9	97.3	79.9	-	-	-
Elizabeth Ann		115.3	106.6	112.6	131.6	95.9	-	-	-
Frank T. Heffelfinger	7/19/91	74.4	102.8	87.9	66.0	65.0	-	-	-
Queen City		105.3	77.8	131.5	87.0	62.7	-	-	-
Helen M. Clements		205.7	163.5	145.3	119.9	133.6	-	-	-
Frank T. Heffelfinger		169.6	105.0	120.2	120.4	123.4	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State		-	-	-	-	-	-	-	-
No name		-	-	-	-	-	-	-	-
Night 1		-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	138.1	161.4	-	-	-	-	-
Lil Charley		-	159.5	180.2	-	-	-	-	-
C.W. Rushing		-	153.2	147.3	-	-	-	-	-
Conti-Nan		-	104.1	86.7	-	-	-	139.4	118.1
Mary L		-	105.6	124.9	-	-	-	-	140.9
Scarlet Knight	7/21/91	-	214.7	204.5	-	-	-	-	-
Conti-Karla		-	118.0	118.6	-	-	-	81.5	96.6

Goose Island Site, Trip 2

30 Minutes after Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	123.2	111.8	-	-	-	-	-
Cooperative Ambassador		-	209.3	178.6	-	-	71.1	67.2	72.4
Eastern		-	162.5	146.0	-	-	73.7	66.6	80.1
Sam M. Fleming		-	138.1	130.2	-	-	66.4	68.8	83.8
Kevin Michael	7/23/91	-	108.9	118.8	-	-	94.3	72.7	68.6
A.M. Thompson		-	139.0	109.5	-	-	61.6	64.1	69.7
Susan Elizabeth		-	147.3	137.8	-	-	61.7	63.9	72.3
Lil Charley		-	147.3	137.8	-	-	61.7	63.9	72.3
Badger		-	151.7	93.5	-	-	62.9	66.3	75.8
Kay D		-	148.9	95.3	-	-	58.5	66.8	77.7
Evey-T		-	97.7	79.3	-	-	-	-	-
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2

60 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		187.5	223.6	172.6	115.4	127.2	-	-	-
Helen M. Clements		123.8	101.9	109.0	101.5	68.5	-	-	-
Elizabeth Ann		-	-	-	-	-	-	-	-
Frank T. Heffelfinger	7/19/91	121.1	128.9	118.3	84.5	72.2	-	-	-
Queen City		101.4	89.0	129.3	75.9	73.2	-	-	-
Helen M. Clements		185.7	85.1	109.6	123.4	128.9	-	-	-
Frank T. Heffelfinger		162.8	87.1	158.2	119.1	123.8	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State		-	-	-	-	-	-	-	-
No name		-	-	-	-	-	-	-	-
Night 1		-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	163.9	179.1	-	-	-	-	-
Lil Charley		-	162.4	169.9	-	-	-	-	-
C.W. Rushing		-	128.7	137.1	-	-	-	-	-
Conti-Nan		-	122.4	137.6	-	-	-	134.6	108.8
Mary L		-	120.5	120.2	-	-	-	-	141.7
Scarlet Knight	7/21/91	-	238.0	230.8	-	-	-	-	-
Conti-Karla		-	118.5	127.0	-	-	-	94.2	83.4

Goose Island Site, Trip 2

60 Minutes after Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	120.3	106.8	-	-	-	-	-
Cooperative Ambassador		-	85.9	110.3	-	-	65.4	67.7	69.4
Eastern		-	89.0	90.1	-	-	70.7	70.6	70.5
Sam M. Fleming		-	115.7	91.8	-	-	81.2	69.2	69.3
Kevin Michael	7/23/91	-	112.5	100.1	-	-	73.4	75.8	83.4
A.M. Thompson		-	137.9	134.4	-	-	63.5	65.6	68.6
Susan Elizabeth		-	120.8	99.3	-	-	63.2	62.7	68.0
Lil Charley		-	120.8	99.3	-	-	63.2	62.7	68.0
Badger		-	94.1	78.6	-	-	-	-	-
Kay D		-	83.3	76.5	-	-	-	-	-
Evey-T		-	-	-	-	-	-	-	-
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2

90 Minutes after Barge-Tow Passage

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-
Scarlet Knight		-	-	-	-	-	-	-	-
James F. Neal		165.8	193.1	141.6	114.9	127.1	-	-	-
Helen M. Clements		109.8	99.8	106.6	127.8	103.4	-	-	-
Elizabeth Ann		-	-	-	-	-	-	-	-
Frank T. Heffelfinger	7/19/91	243.9	137.7	131.6	88.4	64.2	-	-	-
Queen City		100.0	74.2	117.9	92.2	76.8	-	-	-
Helen M. Clements		144.9	86.6	101.7	123.3	124.0	-	-	-
Frank T. Heffelfinger		-	-	-	-	-	-	-	-
Cooperative Venture		-	-	-	-	-	-	-	-
Volunteer State		-	-	-	-	-	-	-	-
No name		-	-	-	-	-	-	-	-
Night 1		-	-	-	-	-	-	-	-
Night 2	7/20/91	-	-	-	-	-	-	-	-
Night 3		-	-	-	-	-	-	-	-
G.R. Packet		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-
Prosperity		-	-	-	-	-	-	-	-
Clyde Butcher		-	154.2	161.8	-	-	-	-	-
Lil Charley		-	141.6	152.6	-	-	-	-	-
C.W. Rushing		-	140.5	150.8	-	-	-	-	-
Conti-Nan		-	109.4	119.9	-	-	-	110.4	146.2
Mary L		-	124.4	126.8	-	-	-	-	132.7
Scarlet Knight	7/21/91	-	156.1	147.9	-	-	-	-	-
Conti-Karla		-	127.4	134.8	-	-	-	93.0	81.1

Goose Island Site, Trip 2

90 Minutes after Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	272.7	184.9	-	-	-	-	-
Cooperative Ambassador		-	112.1	104.9	-	63.3	69.6	79.2	-
Eastern		-	106.2	96.2	-	62.4	71.3	78.5	-
Sam M. Fleming		-	104.7	90.3	-	60.5	74.8	78.7	-
Kevin Michael		-	91.7	80.6	-	64.8	90.3	84.8	-
A.M. Thompson	7/23/91	-	117.6	109.2	-	62.1	63.3	69.4	-
Susan Elizabeth		-	98.9	81.3	-	-	59.4	-	-
Lil Charley		-	98.9	81.3	-	-	-	-	-
Badger		-	-	-	-	-	-	-	-
Kay D		-	-	-	-	-	-	-	-
Evey-T		-	-	-	-	-	-	-	-
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

Goose Island Site, Trip 2

120 Minutes after Barge-Tow Passage

Tow name	Suspended Sediment Concentration, mg/L									
	Date	Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2	
Ardyce Randall	7/18/91	-	-	-	-	-	-	-	-	
Scarlet Knight		-	-	-	-	-	-	-	-	
James F. Neal		127.2	116.9	102.9	117.4	125.7	-	-	-	
Helen M. Clements		-	-	-	-	-	-	-	-	
Elizabeth Ann		-	-	-	-	-	-	-	-	
Frank T. Heffelfinger	7/19/91	109.1	97.2	91.5	78.0	63.9	-	-	-	
Queen City		107.3	74.5	135.6	102.2	75.6	-	-	-	
Helen M. Clements		-	-	-	-	-	-	-	-	
Frank T. Heffelfinger		-	-	-	-	-	-	-	-	
Cooperative Venture		-	-	-	-	-	-	-	-	
Volunteer State		-	-	-	-	-	-	-	-	
No name		-	-	-	-	-	-	-	-	
Night 1		-	-	-	-	-	-	-	-	
Night 2	7/20/91	-	-	-	-	-	-	-	-	
Night 3		-	-	-	-	-	-	-	-	
G.R. Packet		-	-	-	-	-	-	-	-	
Prairie Dawn		-	-	-	-	-	-	-	-	
Prosperity		-	-	-	-	-	-	-	-	
Clyde Butcher		-	237.2	280.1	-	-	-	-	-	
Lil Charley		-	148.3	173.1	-	-	-	-	-	
C.W. Rushing		-	133.0	125.0	-	-	-	-	-	
Conti-Nan		-	120.4	119.4	-	-	-	111.6	140.5	
Mary L		-	-	-	-	-	-	-	-	
Scarlet Knight	7/21/91	-	146.3	175.7	-	-	-	-	-	
Conti-Karla		-	98.5	103.4	-	-	-	89.2	76.9	

Goose Island Site, Trip 2

120 Minutes after Barge-Tow Passage (Concluded)

Tow name	Date	Suspended Sediment Concentration, mg/L							
		Station a1	Station b1	Station b2	Station c1	Station c2	Station d1	Station e1	Station e2
Cooperative Mariner	7/22/91	-	-	-	-	-	-	-	-
Hornet		-	105.9	130.6	-	-	-	-	-
Cooperative Ambassador		-	99.0	89.9	-	-	72.9	72.3	83.5
Eastern		-	96.2	86.4	-	-	70.7	74.0	85.0
Sam M. Fleming		-	94.2	84.0	-	-	68.4	80.3	85.0
Kevin Michael	7/23/91	-	118.8	104.0	-	-	72.5	74.7	78.3
A.M. Thompson		-	122.7	109.4	-	-	63.3	64.2	68.3
Susan Elizabeth		-	157.6	87.3	-	-	62.0	65.4	74.4
Lil Charley		-	157.6	87.3	-	-	62.0	65.4	74.4
Badger		-	-	-	-	-	-	-	-
Kay D		-	-	-	-	-	-	-	-
Evey-T		-	-	-	-	-	-	-	-
Robert Ingle		-	-	-	-	-	-	-	-
Prairie Dawn		-	-	-	-	-	-	-	-

APPENDIX XIX.
DATABASE ORGANIZATION FOR ALL STUDY SITES

DATABASE ORGANIZATION

The following eight databases were established for storing data from each site and trip:

<i>Database name</i>	<i>Database contents</i>	<i>No. of tables</i>
mcevers	McEver's Island data	21
applrivr	Apple River Island data	24
goose1	Goose Island, Trip 1 data	24
goose2	Goose Island, Trip 2 data	27
kamp1	Kampsville, Trip 1 data	25
kamp2	Kampsville, Trip 2 data	9
clarks1	Clarks Ferry, Trip 1 data	26
clarks2	Clarks Ferry, Trip 2 data	11

McEver's Island Site

This section describes the 21 tables of the "mcevers" database.

ambvel1 : Contains the data for the mean ambient velocity from
MMB511/998,999,1000,1001 meters before barge-tow passage.

ambvel2 : Contains the data for the mean ambient velocity from
MMB527/642 and S4/071 meters before barge-tow passage.

impvel1 : Contains the data for the impact velocity from
MMB511/998,999,1000,1001 meters during barge-tow passage.

impvel2 : Contains the data for the impact velocity from
MMB527/642 and S4/071 meters during barge-tow passage.

brgeinfo : Contains the data for the traffic characteristics.

wvhtdrdn : Contains the data for the maximum waveheight and
maximum drawdown.

watrslope : Contains the data for the water surface slopes.

bedprtl : Contains the data for the bed material characteristics.

peakssc : Contains the data for the peak suspended sediment
concentrations for the events for this trip.

avssc : Contains the data for the average suspended sediment
concentrations during the events for this trip.

ssc2bef : Contains the data for the suspended sediment concentrations
2 minutes prior to barge-tow passage for this trip.

ssc5bef : Contains the data for the suspended sediment concentrations
5 minutes prior to barge-tow passage for this trip.

ssc10bef : Contains the data for the suspended sediment concentrations
10 minutes prior to barge-tow passage for this trip.

ssc30bef : Contains the data for the suspended sediment concentrations
30 minutes prior to barge-tow passage for this trip.

McEver's Island Site (Concluded)

ssc60bef : Contains the data for the suspended sediment concentrations

60 minutes prior to barge-tow passage for this trip.

ssc2af : Contains the data for the suspended sediment concentrations

2 minutes after barge-tow passage for this trip.

ssc5af : Contains the data for the suspended sediment concentrations

5 minutes after barge-tow passage for this trip.

ssc30af : Contains the data for the suspended sediment concentrations

30 minutes after barge-tow passage for this trip.

ssc60af : Contains the data for the suspended sediment concentrations

60 minutes after barge-tow passage for this trip.

ssc90af : Contains the data for the suspended sediment concentrations

90 minutes after barge-tow passage for this trip.

ssc120af : Contains the data for the suspended sediment concentrations

120 minutes after barge-tow passage for this trip.

Apple River Island Site

This section describes the 24 tables of the “applriv” database.

ambvel1 : Contains the data for the mean ambient velocity from
MMB511/998,1000,1001 and MMB527/332,642 meters before
barge-tow passage.

ambvel2 : Contains the data for the mean ambient velocity from
MMB511/999 and S4/071,040 meters before barge-tow passage.

impvel1 : Contains the data for the impact velocity from
MMB511/998,1000,1001 and MMB527/332,642 meters during
barge-tow passage.

impvel2 : Contains the data for the impact velocity from
MMB511/999 and S4/071,040 meters during barge-tow passage.

brgeinfo : Contains the data for the traffic characteristics.

wvhtdrdn : Contains the data for the maximum waveheight and
maximum drawdown.

watrslope : Contains the data for the water surface slopes.

windinfo : Contains the data for wind speed and direction.

tempinfo : Contains the data for water and air temperatures and stages
for this trip.

recvesl : Contains the data for the recreational vessels characteristics.

bedprctl : Contains the data for the bed material characteristics.

peakssc : Contains the data for the peak suspended sediment
concentrations for the events for this trip.

avssc : Contains the data for the average suspended sediment
concentrations during the events for this trip.

ssc2bef : Contains the data for the suspended sediment concentrations
2 minutes prior to barge-tow passage for this trip.

Apple River Island Site (Concluded)

- ssc5bef : Contains the data for the suspended sediment concentrations
5 minutes prior to barge-tow passage for this trip.
- ssc10bef : Contains the data for the suspended sediment concentrations
10 minutes prior to barge-tow passage for this trip.
- ssc30bef : Contains the data for the suspended sediment concentrations
30minutes prior to barge-tow passage for this trip.
- ssc60bef : Contains the data for the suspended sediment concentrations
60 minutes prior to barge-tow passage for this trip.
- ssc2af : Contains the data for the suspended sediment concentrations
2 minutes after barge-tow passage for this trip.
- ssc5af : Contains the data for the suspended sediment concentrations
5 minutes after barge-tow passage for this trip.
- ssc30af : Contains the data for the suspended sediment concentrations
30 minutes after barge-tow passage for this trip.
- ssc60af : Contains the data for the suspended sediment concentrations
60 minutes after barge-tow passage for this trip.
- ssc90af : Contains the data for the suspended sediment concentrations
90 minutes after barge-tow passage for this trip.
- ssc120af : Contains the data for the suspended sediment concentrations
120 minutes after barge-tow passage for this trip.

Goose Island Site, Trip 1

This section describes the 24 tables of the “goose1” database.

- ambvel1** : Contains the data for the mean ambient velocity from
MMB511/998,999,1000,1001 and MMB527/642 meters before
barge-tow passage.
- ambvel2** : Contains the data for the mean ambient velocity from
MMB527/332 and S4/071,040 meters before barge-tow passage.
- impvel1** : Contains the data for the impact velocity from
MMB511/998,999,1000,1001 and MMB527/642 meters during
barge-tow passage.
- impvel2** : Contains the data for the impact velocity from
MMB527/332 and S4/071,040 meters during barge-tow passage.
- brgeinfo** : Contains the data for the traffic characteristics.
- wvhtdrdn** : Contains the data for the maximum waveheight and
maximum drawdown.
- watrslope** : Contains the data for the water surface slopes.
- windinfo** : Contains the data for wind speed and direction.
- tempinfo** : Contains the data for water and air temperatures and stages
for this trip.
- recvesl** : Contains the data for the recreational vessels characteristics.
- bedprctl** : Contains the data for the bed material characteristics.
- peakssc** : Contains the data for the peak suspended sediment
concentrations for the events for this trip.
- avssc** : Contains the data for the average suspended sediment
concentrations during the events for this trip.
- ssc2bef** : Contains the data for the suspended sediment concentrations
2 minutes prior to barge-tow passage for this trip.

Goose Island Site, Trip 1 (Concluded)

- ssc5bef : Contains the data for the suspended sediment concentrations
5 minutes prior to barge-tow passage for this trip.
- ssc10bef : Contains the data for the suspended sediment concentrations
10 minutes prior to barge-tow passage for this trip.
- ssc30bef : Contains the data for the suspended sediment concentrations
30minutes prior to barge-tow passage for this trip.
- ssc60bef : Contains the data for the suspended sediment concentrations
60 minutes prior to barge-tow passage for this trip.
- ssc2af : Contains the data for the suspended sediment concentrations
2 minutes after barge-tow passage for this trip.
- ssc5af : Contains the data for the suspended sediment concentrations
5 minutes after barge-tow passage for this trip.
- ssc30af : Contains the data for the suspended sediment concentrations
30 minutes after barge-tow passage for this trip.
- ssc60af : Contains the data for the suspended sediment concentrations
60 minutes after barge-tow passage for this trip.
- ssc90af : Contains the data for the suspended sediment concentrations
90 minutes after barge-tow passage for this trip.
- ssc120af : Contains the data for the suspended sediment concentrations
120 minutes after barge-tow passage for this trip.

Goose Island Site, Trip 2

This section describes the 27 tables of the "goose2" database.

ambvel1 : Contains the data for the mean ambient velocity from

MMB511/998,999,1001,1130,1131 meters before
barge-tow passage.

ambvel2 : Contains the data for the mean ambient velocity from

MMB511/1000,MMB527/332,642 and S4/071,151 meters before
barge-tow passage.

ambvel3 : Contains the data for the mean ambient velocity from

S4/040,832,834 meters before barge-tow passage.

impvel1 : Contains the data for the impact velocity from

MMB511/998,999,1001,1130,1131 meters during barge-tow
passage.

impvel2 : Contains the data for the impact velocity from MMB511/1000,

MMB527/332,642 and S4/071,151 meters during barge-tow
passage.

impvel3 : Contains the data for the impact velocity from S4/040,832,834

meters during barge-tow passage.

brgeinfo : Contains the data for the traffic characteristics.

wvhtdrdn : Contains the data for the maximum waveheight and

maximum drawdown.

watrslope : Contains the data for the water surface slopes.

windinfo : Contains the data for wind speed and direction.

tempinfo : Contains the data for water and air temperatures and stages
for this trip.

recvesl : Contains the data for the recreational vessels characteristics.

bedptcl : Contains the data for the bed material characteristics.

Goose Island Site, Trip 2 (Concluded)

- ambssc** : Contains the data for ambient suspended sediment concentrations.
- peakssc** : Contains the data for the peak suspended sediment concentrations for the events for this trip.
- avssc** : Contains the data for the average suspended sediment concentrations during the events for this trip.
- ssc2bef** : Contains the data for the suspended sediment concentrations 2 minutes prior to barge-tow passage for this trip.
- ssc5bef** : Contains the data for the suspended sediment concentrations 5 minutes prior to barge-tow passage for this trip.
- ssc10bef** : Contains the data for the suspended sediment concentrations 10 minutes prior to barge-tow passage for this trip.
- ssc30bef** : Contains the data for the suspended sediment concentrations 30minutes prior to barge-tow passage for this trip.
- ssc60bef** : Contains the data for the suspended sediment concentrations 60 minutes prior to barge-tow passage for this trip.
- ssc2af** : Contains the data for the suspended sediment concentrations 2 minutes after barge-tow passage for this trip.
- ssc5af** : Contains the data for the suspended sediment concentrations 5 minutes after barge-tow passage for this trip.
- ssc30af** : Contains the data for the suspended sediment concentrations 30 minutes after barge-tow passage for this trip.
- ssc60af** : Contains the data for the suspended sediment concentrations 60 minutes after barge-tow passage for this trip.
- ssc90af** : Contains the data for the suspended sediment concentrations 90 minutes after barge-tow passage for this trip.
- ssc120af** : Contains the data for the suspended sediment concentrations 120 minutes after barge-tow passage for this trip.

Kampsville Site, Trip 1

This section describes the 25 tables of the “kamp1” database.

ambvel1 : Contains the data for the mean ambient velocity from

MMB511/998,999,1000,1001 and MMB527/642 meters before
barge-tow passage.

ambvel2 : Contains the data for the mean ambient velocity from

MMB527/332 and S4/040,071 meters before barge-tow passage.

impvel1 : Contains the data for the impact velocity from

MMB511/998,999,1000,1001 and MMB527/642 meters during
barge-tow passage.

impvel2 : Contains the data for the impact velocity from MMB527/332 and

S4/040,071 meters during barge-tow passage.

brgeinfo : Contains the data for the traffic characteristics.

wvhtdrdn : Contains the data for the maximum waveheight and
maximum drawdown.

watrslope : Contains the data for the water surface slopes.

windinfo : Contains the data for wind speed and direction.

tempinfo : Contains the data for water and air temperatures and stages
for this trip.

recvesl : Contains the data for the recreational vessels characteristics.

bedprtcl : Contains the data for the bed material characteristics.

ambssc : Contains the data for ambient suspended sediment
concentrations.

peakssc : Contains the data for the peak suspended sediment
concentrations for the events for this trip.

avssc : Contains the data for the average suspended sediment
concentrations during the events for this trip.

Kampsville Site, Trip 1 (Concluded)

ssc2bef : Contains the data for the suspended sediment concentrations
2 minutes prior to barge-tow passage for this trip.

ssc5bef : Contains the data for the suspended sediment concentrations
5 minutes prior to barge-tow passage for this trip.

ssc10bef : Contains the data for the suspended sediment concentrations
10 minutes prior to barge-tow passage for this trip.

ssc30bef : Contains the data for the suspended sediment concentrations
30minutes prior to barge-tow passage for this trip.

ssc60bef : Contains the data for the suspended sediment concentrations
60 minutes prior to barge-tow passage for this trip.

ssc2af : Contains the data for the suspended sediment concentrations
2 minutes after barge-tow passage for this trip.

ssc5af : Contains the data for the suspended sediment concentrations
5 minutes after barge-tow passage for this trip.

ssc30af : Contains the data for the suspended sediment concentrations
30 minutes after barge-tow passage for this trip.

ssc60af : Contains the data for the suspended sediment concentrations
60 minutes after barge-tow passage for this trip.

ssc90af : Contains the data for the suspended sediment concentrations
90 minutes after barge-tow passage for this trip.

ssc120af : Contains the data for the suspended sediment concentrations
120 minutes after barge-tow passage for this trip.

Kampsville Site, Trip 2

This section describes the 9 tables of the “kamp2” database.

ambvel1 : Contains the data for the mean ambient velocity from

MMB511/998,999,1001 meters before barge-tow passage.

ambvel2 : Contains the data for the mean ambient velocity from

MMB511/1000 and MMB527/332,642 meters before barge-tow passage.

impvel1 : Contains the data for the impact velocity from

MMB511/998,999,1001 meters during barge-tow passage.

impvel2 : Contains the data for the impact velocity from MMB511/1000 and

MMB527/332,642 meters during barge-tow passage.

brgeinfo : Contains the data for the traffic characteristics.

wvhtdrdn : Contains the data for the maximum waveheight and maximum drawdown.

watrslope : Contains the data for the water surface slopes.

tempinfo : Contains the data for water and air temperatures and stages for this trip.

ambssc : Contains the data for ambient suspended sediment concentrations

Clarks Ferry Site, Trip 1

This section describes the 26 tables of the "clarks1" database.

ambvel1 : Contains the data for the mean ambient velocity from

MMB511/1001,1130,1131,998,999 meters before barge-tow
passage.

ambvel2 : Contains the data for the mean ambient velocity from

MB511/1000,MMB527/332,642 and S4/151,834 meters before
barge-tow passage.

ambvel3 : Contains the data for the mean ambient velocity from

S4/040,832,071 meters before barge-tow passage.

impvel1 : Contains the data for the impact velocity from

MMB511/1001,1130,1131,998,999 meters during barge-tow
passage.

impvel2 : Contains the data for the impact velocity from MMB511/1000,

MMB527/332,642 and S4/151,834 meters during barge-tow
passage.

impvel3 : Contains the data for the impact velocity from S4/040,832,071

meters during barge-tow passage.

brgeinfo : Contains the data for the traffic characteristics.

wvhtdrdn : Contains the data for the maximum waveheight and

maximum drawdown.

watrslope : Contains the data for the water surface slopes.

windinfo : Contains the data for wind speed and direction.

tempinfo : Contains the data for water and air temperatures and stages

for this trip.

recvesl : Contains the data for the recreational vessels characteristics.

ambssc : Contains the data for ambient suspended sediment concentrations.

Clarks Ferry Site, Trip 1 (Concluded)

- peakssc** : Contains the data for the peak suspended sediment concentrations for the events for this trip.
- avssc** : Contains the data for the average suspended sediment concentrations during the events for this trip.
- ssc2bef** : Contains the data for the suspended sediment concentrations 2 minutes prior to barge-tow passage for this trip.
- ssc5bef** : Contains the data for the suspended sediment concentrations 5 minutes prior to barge-tow passage for this trip.
- ssc10bef** : Contains the data for the suspended sediment concentrations 10 minutes prior to barge-tow passage for this trip.
- ssc30bef** : Contains the data for the suspended sediment concentrations 30minutes prior to barge-tow passage for this trip.
- ssc60bef** : Contains the data for the suspended sediment concentrations 60 minutes prior to barge-tow passage for this trip.
- ssc2af** : Contains the data for the suspended sediment concentrations 2 minutes after barge-tow passage for this trip.
- ssc5af** : Contains the data for the suspended sediment concentrations 5 minutes after barge-tow passage for this trip.
- ssc30af** : Contains the data for the suspended sediment concentrations 30 minutes after barge-tow passage for this trip.
- ssc60af** : Contains the data for the suspended sediment concentrations 60 minutes after barge-tow passage for this trip.
- ssc90af** : Contains the data for the suspended sediment concentrations 90 minutes after barge-tow passage for this trip.
- ssc120af** : Contains the data for the suspended sediment concentrations 120 minutes after barge-tow passage for this trip.

Clarks Ferry Site, Trip 2

This section describes the 11 tables of the "clarks2" database.

- ambvel1** : Contains the data for the mean ambient velocity from
MMB511/998,999,1000,1001,1130 meters before barge-tow
passage.
- ambvel2** : Contains the data for the mean ambient velocity from
MB511/1131,MMB527/332,642 and S4/834 meters before barge-
tow passage.
- ambvel3** : Contains the data for the mean ambient velocity from
S4/151,832,040 meters before barge-tow passage.
- impvel1** : Contains the data for the impact velocity from
511/998,999,1000,1001,1130 meters during barge-tow passage.
- impvel2** : Contains the data for the impact velocity from MMB511/1131,
MMB527/332,642 and S4/834 meters during barge-tow passage.
- impvel3** : Contains the data for the impact velocity from S4/151,832,040
meters during barge-tow passage.
- brgeinfo** : Contains the data for the traffic characteristics.
- wvhtdrdn** : Contains the data for the maximum waveheight and
maximum drawdown.
- tempinfo** : Contains the data for water and air temperatures and stages
for this trip
- recvesl** : Contains the data for the recreational vessels characteristics.
- bedprctl** : Contains the data for the bed material characteristics.

APPENDIX XX.

**SAMPLE PLOTS OF ALTERED VELOCITY REGIMES
DUE TO MOVEMENT OF NAVIGATION TRAFFIC**

XX-1. Velocity fluctuations measured by two-dimensional current meters
for barge *Reliance*, McEver's Island

Reliance (5/18/89)

Status of Electromagnetic Current Meters:

998	999	1000	1001
(MMB511)	(MMB511)	(MMB511)	(MMB511)
✓	✓	✓	*

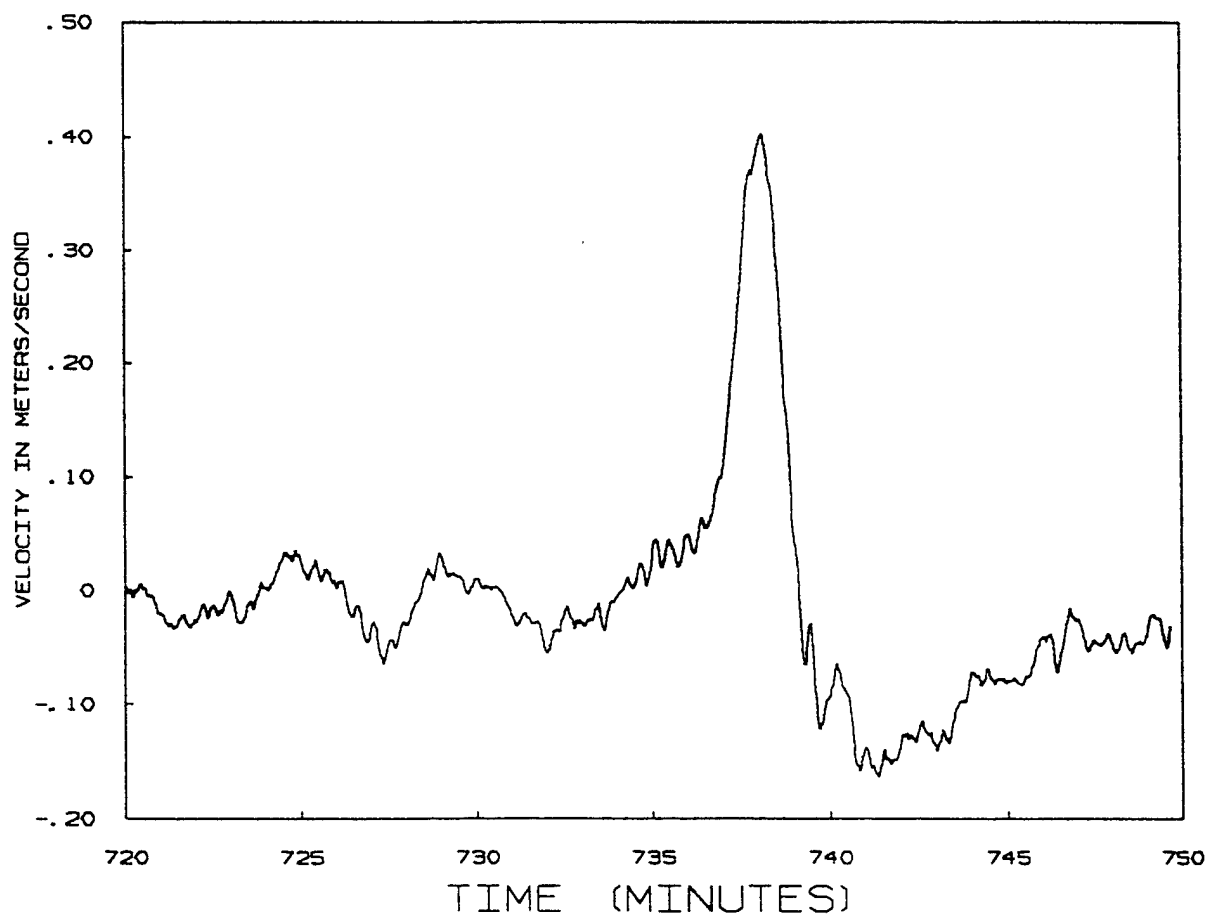
642
(MMB527)
✓

071
(S4)
✓

Note: ✓ : Working
* : Not working
- : Unavailable

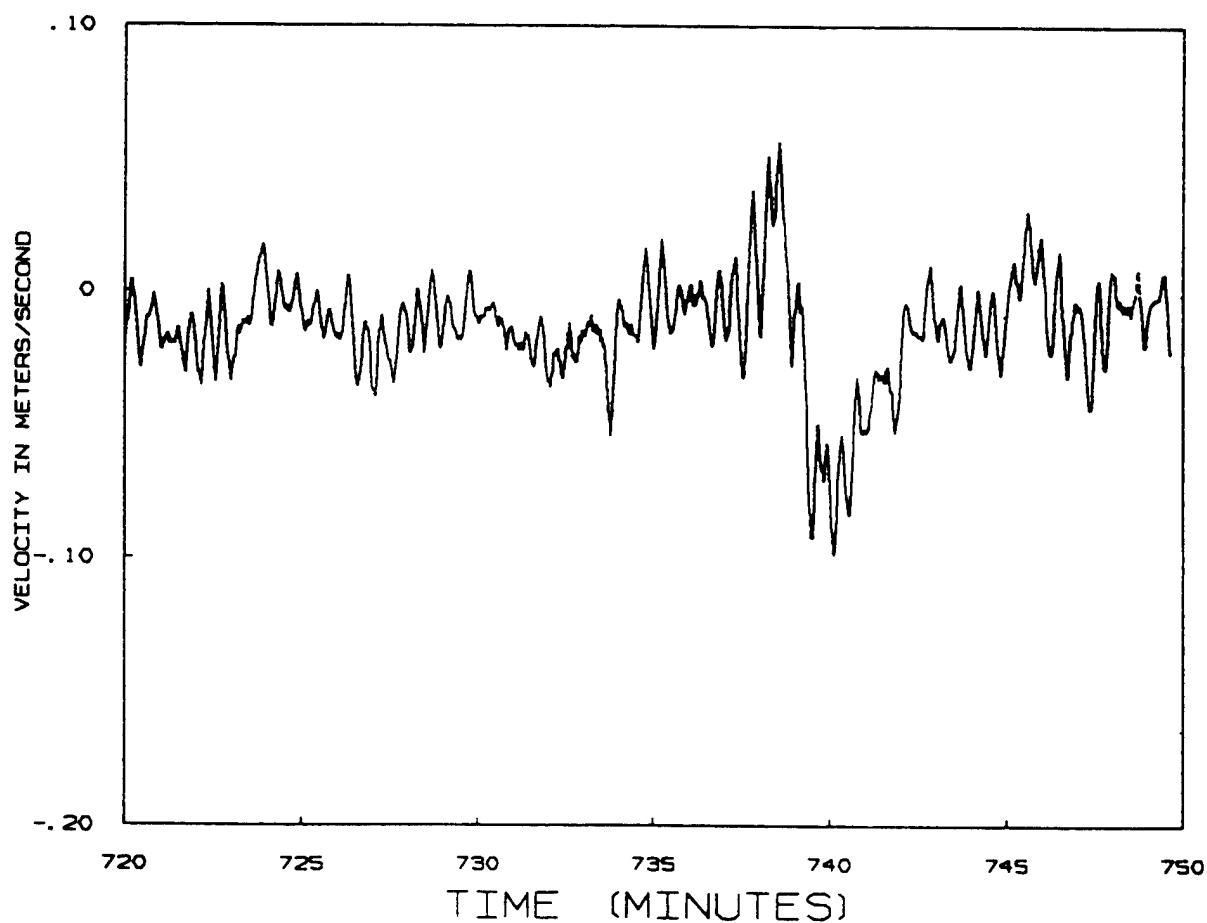
meter number	511- 998	start-time	1200
tow name	reliance	end-time	1230
configuration	3x5	mean =	-0.01
draft	6.8	vmax =	0.00 tmax = 738.
speed	5.1 mph	vmin =	0.00 tmin = 741.
direction	upstream		
distance	623		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



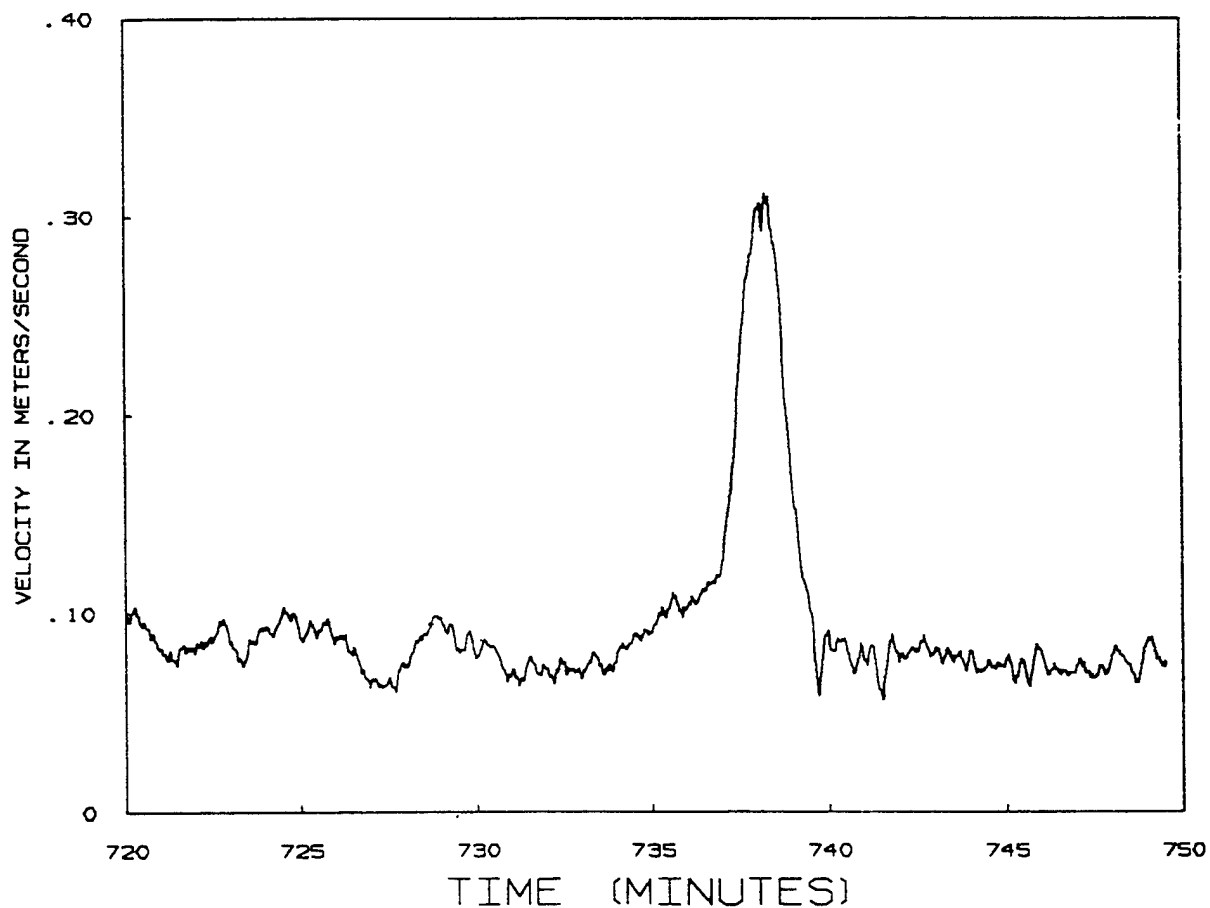
meter number	511- 998	start-time	1200
tow name	reliance	end-time	1230
configuration	3x5	mean =	-0.01
draft	6.8	vmax =	0.00 tmax = 739.
speed	5.1 mph	vmin =	0.00 tmin = 740.
direction	upstream		
distance	623		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



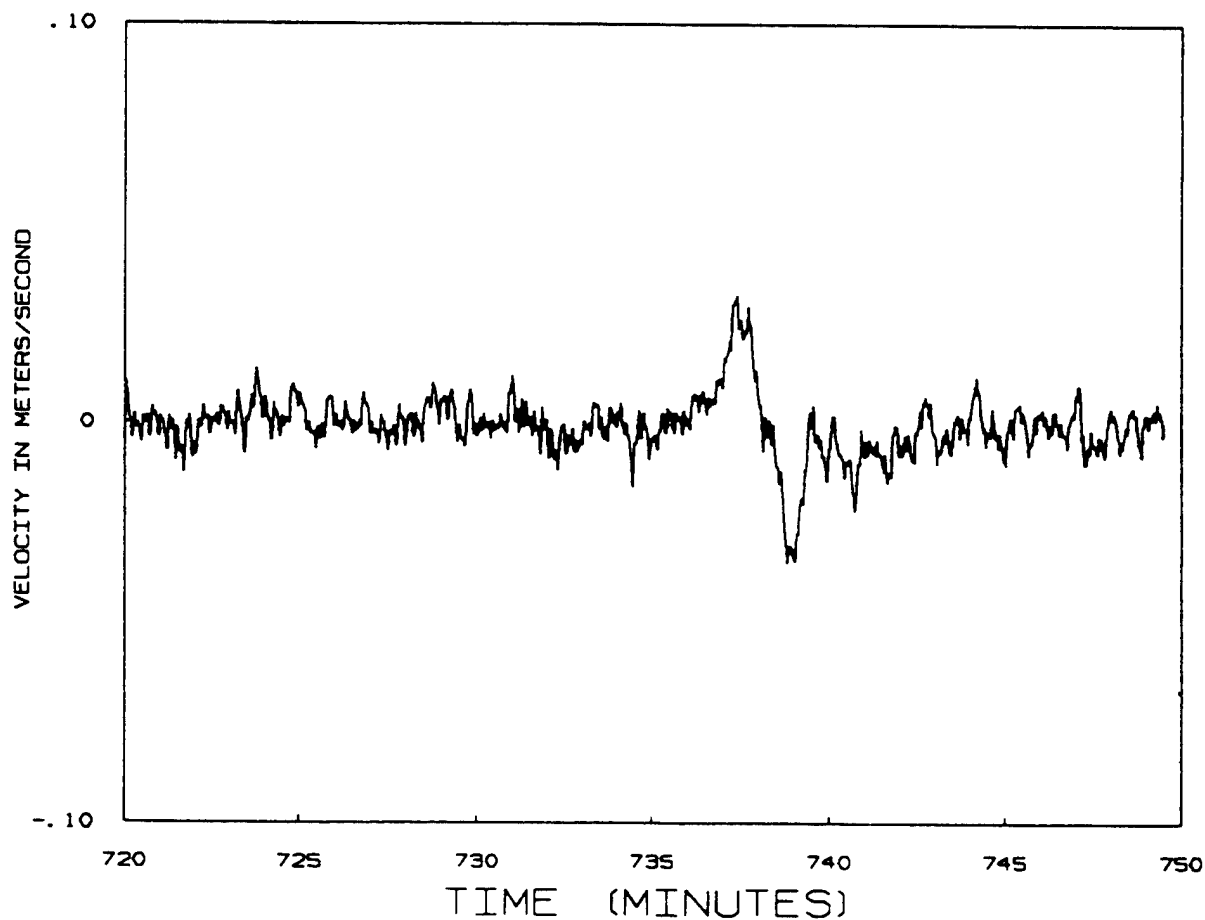
meter number	999	distance	623
tow name	reliance	start-time	1200
configuration	3x5	end-time	1230
draft	6.8	mean =	0.09
speed	5.1 mph	vmax =	0.31 tmax = 738.
direction	upstream	vmin =	0.06 tmin = 742.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



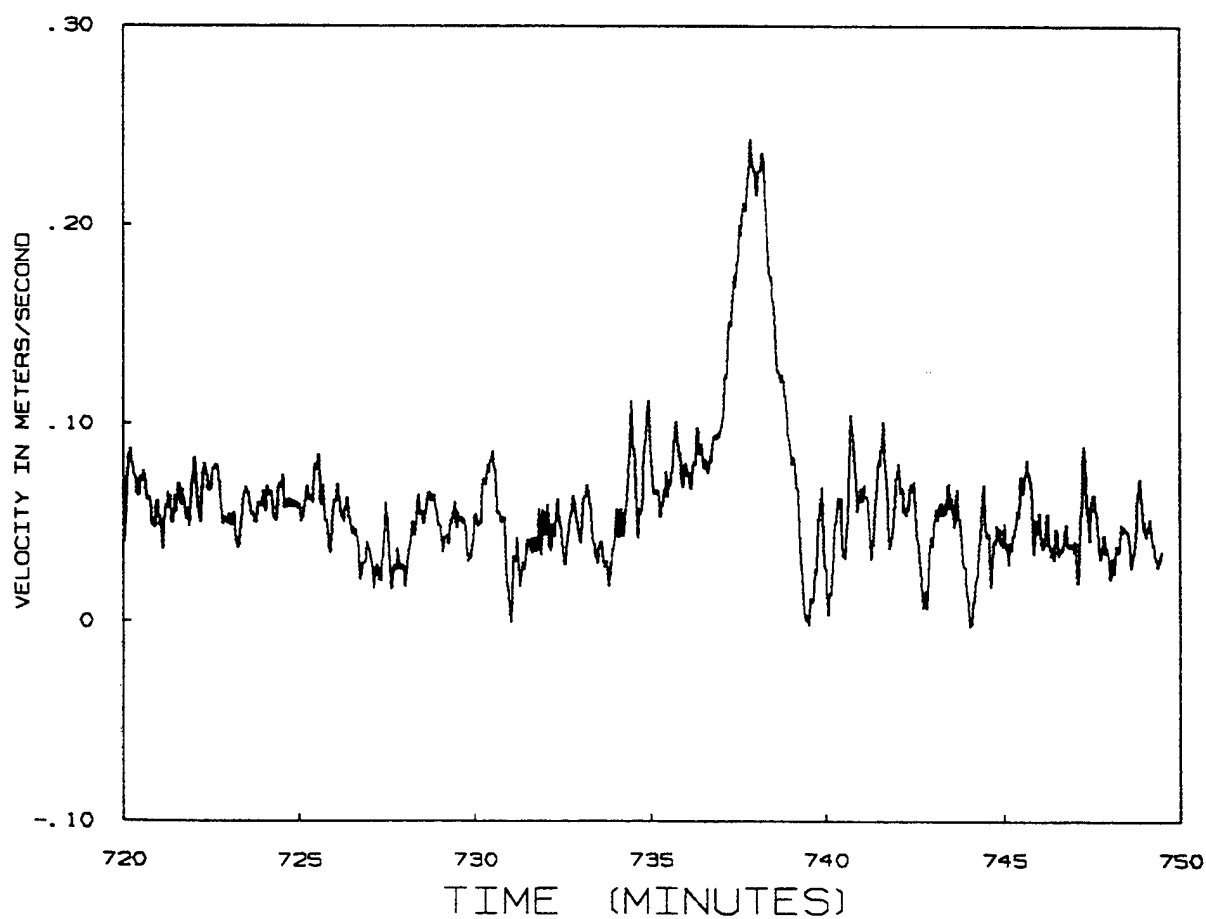
meter number	999	distance	623
tow name	reliance	start-time	1200
configuration	3x5	end-time	1230
draft	6.8	mean =	0.00
speed	5.1 mph	vmax =	0.03 tmax = 737.
direction	upstream	vmin =	-0.03 tmin = 739.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



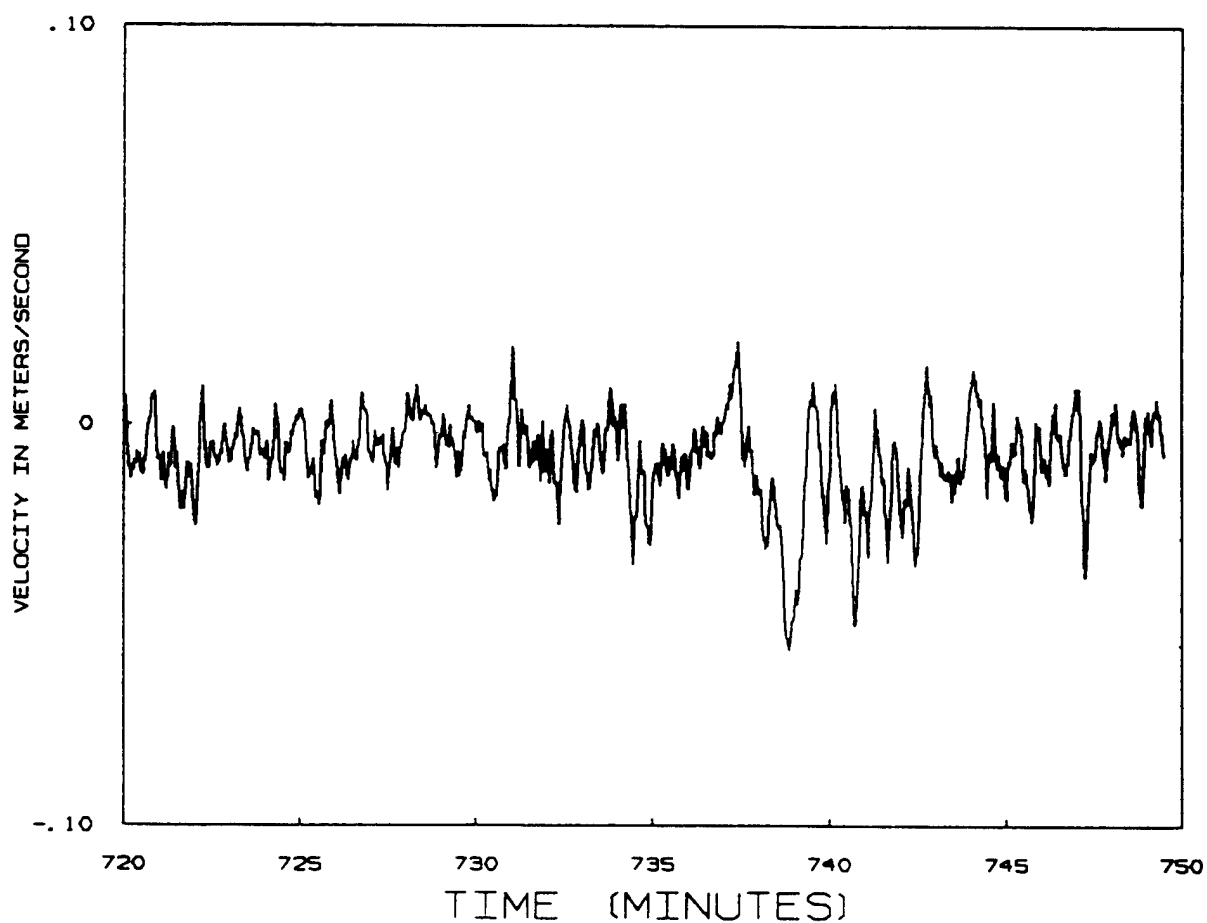
meter number	1000	distance	623
tow name	reliance	start-time	1200
configuration	3x5	end-time	1230
draft	6.8	mean =	0.05
speed	5.1 mph	vmax =	0.24 tmax = 738.
direction	upstream	vmin =	0.00 tmin = 744.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



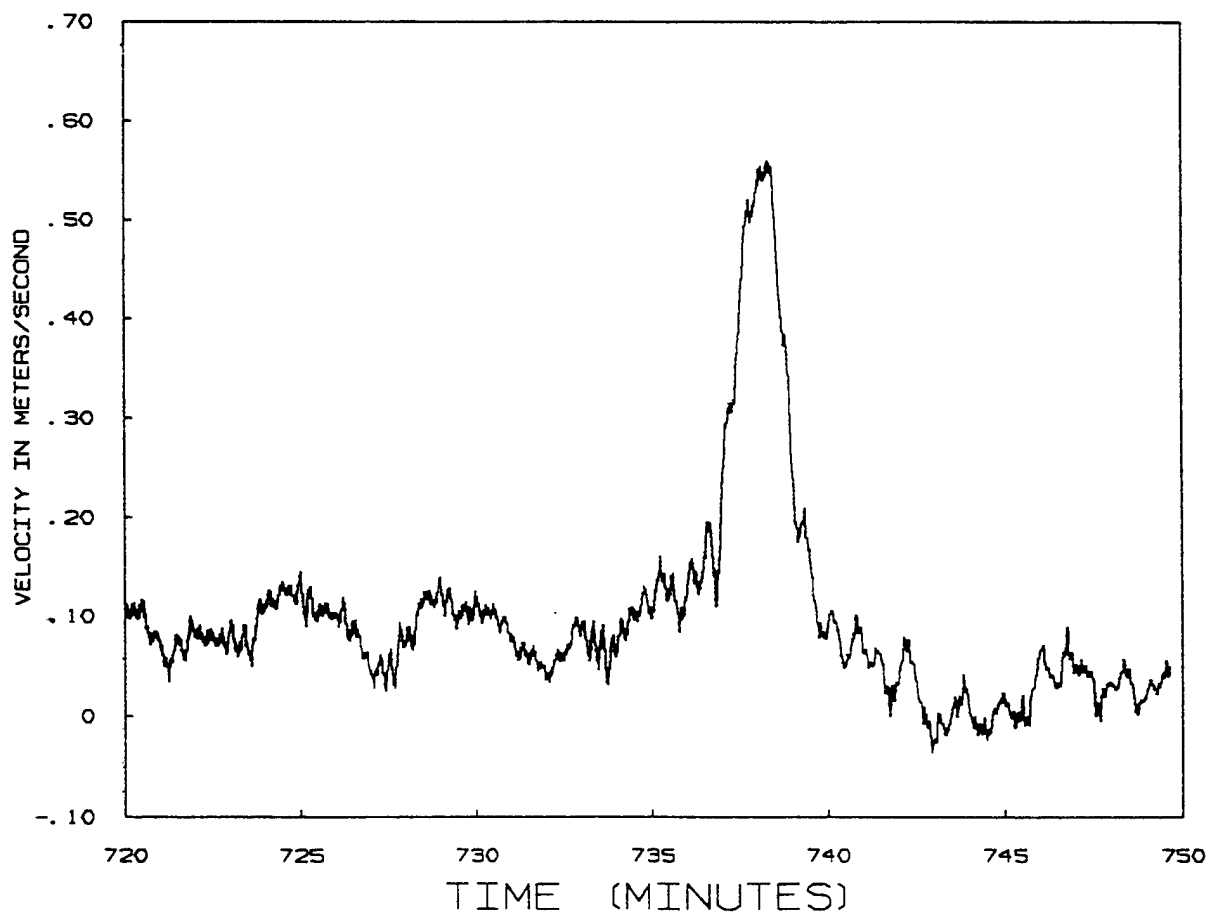
meter number	1000	distance	623
tow name	reliance	start-time	1200
configuration	3x5	end-time	1230
draft	6.8	mean =	-0.01
speed	5.1 mph	vmax =	0.02 tmax = 737.
direction	upstream	vmin =	-0.06 tmin = 739.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



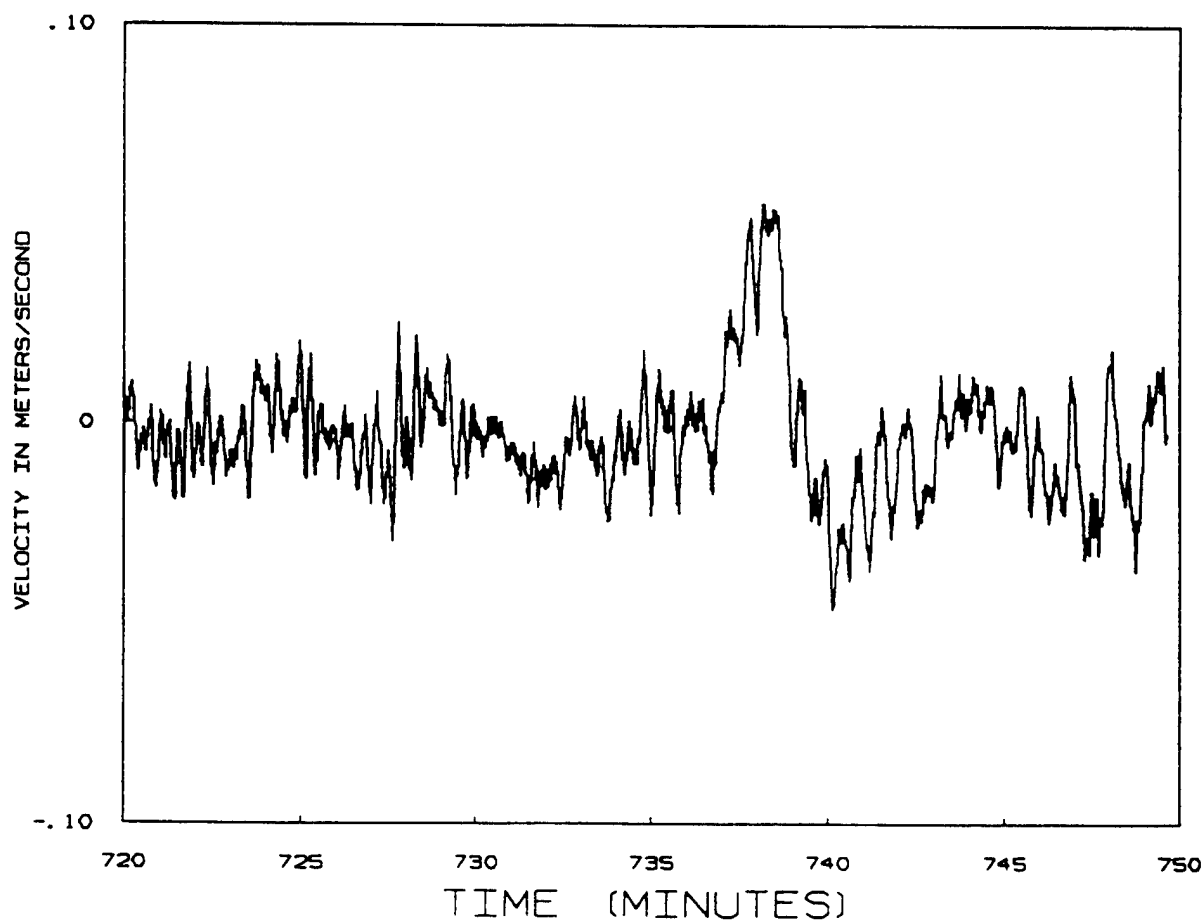
meter number	B-642	start-time	1200
tow name	reliance	end-time	1230
configuration	3x5	mean =	0.09
draft	6.8	vmax =	0.00 tmax = 738.
speed	5.1 mph	vmin =	0.00 tmin = 743.
direction	upstream		
distance	623		

MARSH MCBIRNEY S11/S27 PLOTTING ROUTINE X - COMPONENT

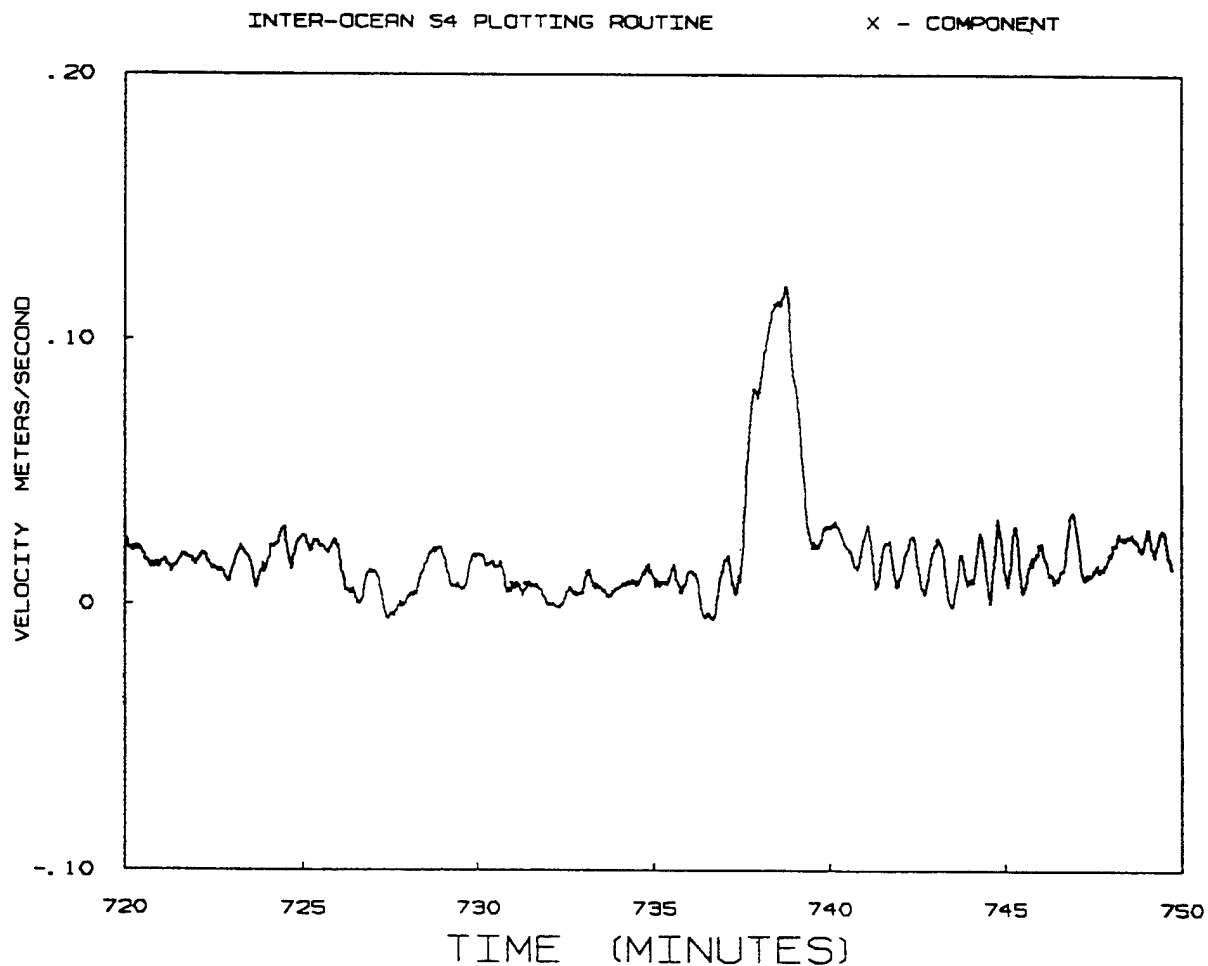


meter number	B-642	start-time	1200
tow name	reliance	end-time	1230
configuration	3x5	mean =	0.00
draft	6.8	vmax =	0.00 tmax = 738.
speed	5.1 mph	vmin =	0.00 tmin = 740.
direction	upstream		
distance	623		

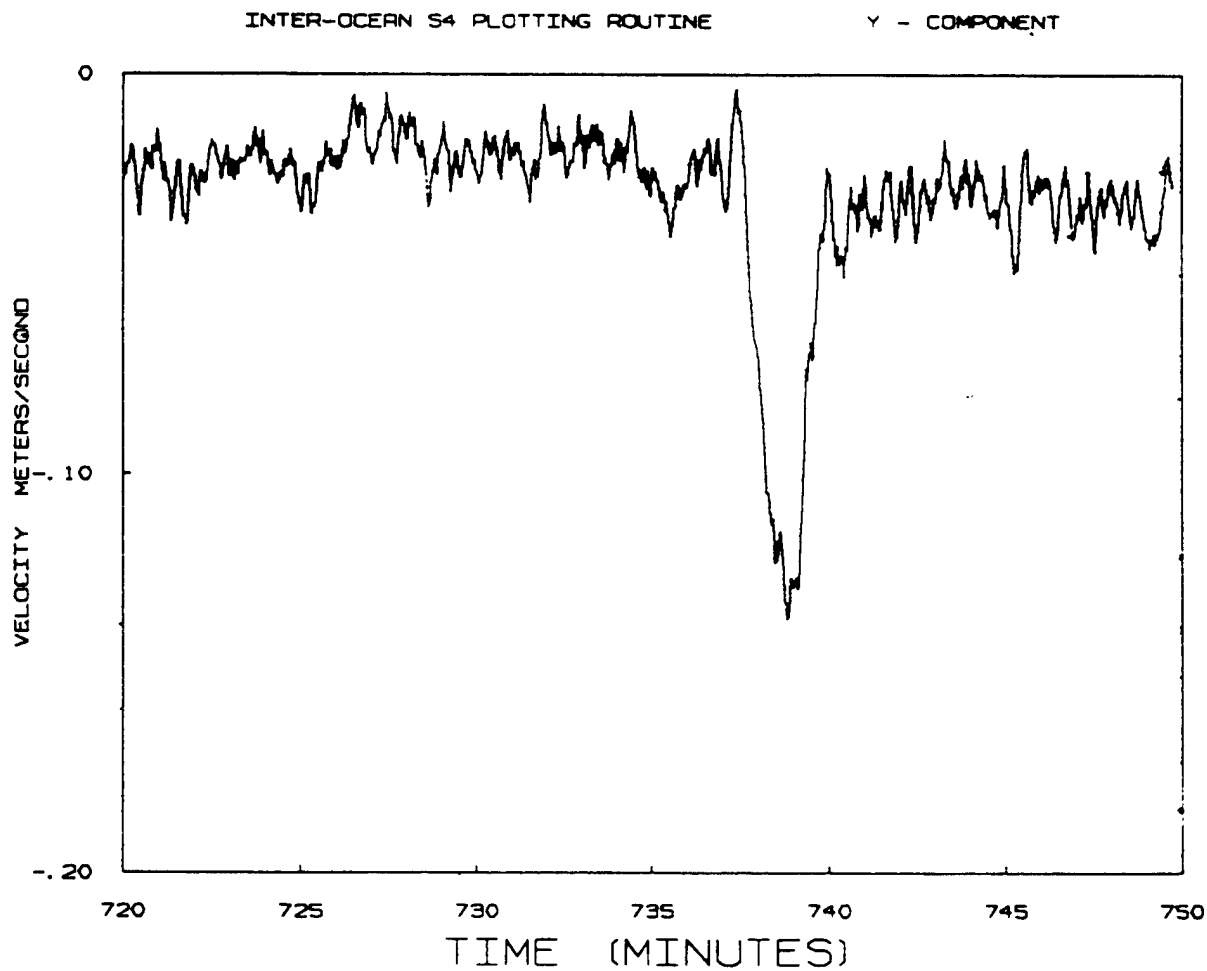
MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



meter number	071	distance	623
tow name	reliance	start-time	1200
configuration	3x5	end-time	1230
draft	6.8	MEAN =	0.01
speed	5.1 mph	VMAX =	0.12 TMAX = 739.
direction	upstream	VMIN =	-0.01 TMIN = 737.



meter number	071	distance	623
tow name	reliance	start-time	1200
configuration	3x5	end-time	1230
draft	6.8	MEAN	= -0.02
speed	5.1 mph	VMAX	= 0.00 TMAX = 737.
direction	upstream	VMIN	= -0.14 TMIN = 739.



XX-2. Velocity fluctuations measured by two-dimensional current meters
for barge *D. Ray Miller*, Apple River Island

D. Ray Miller (5/21/90)

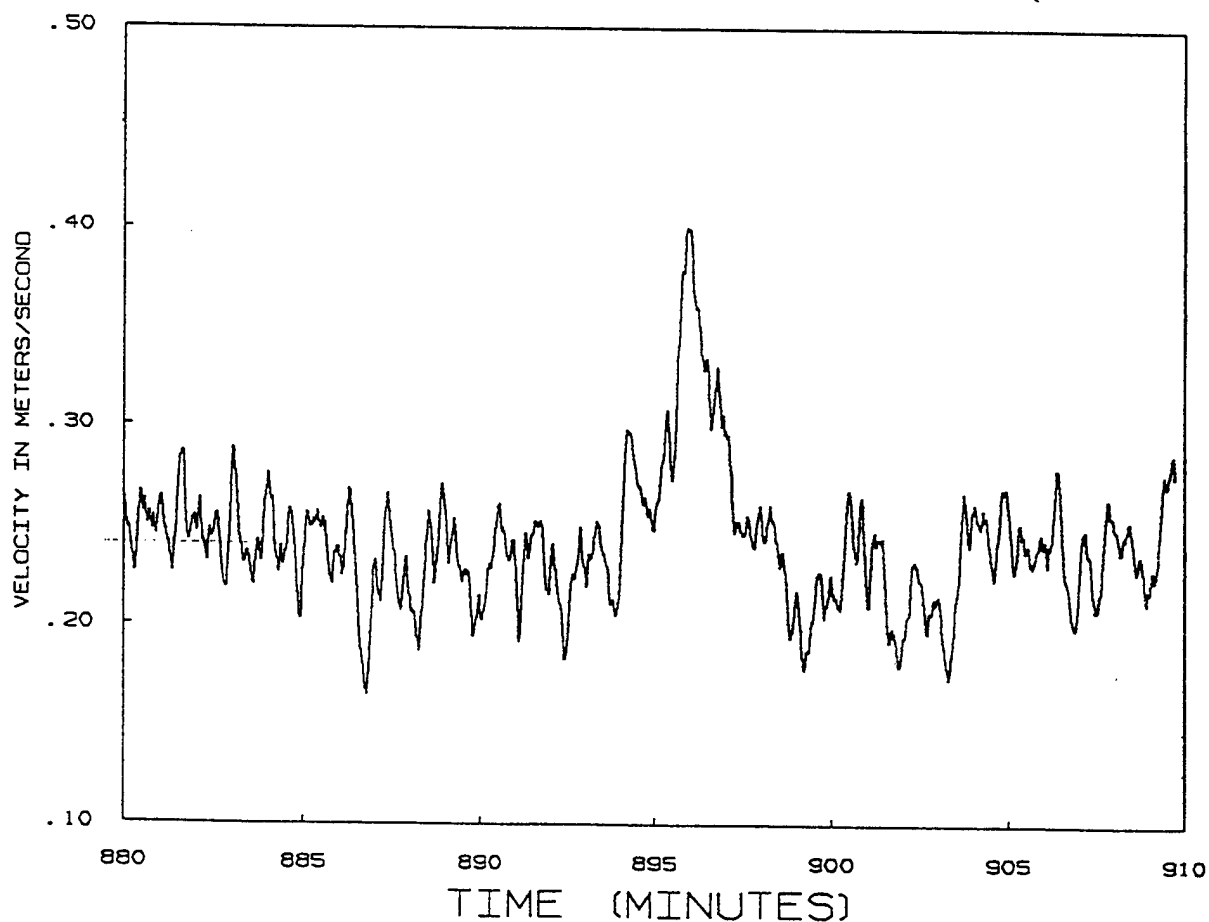
Status of Electromagnetic Current Meters:

1001 (MMB511) ✓	1000 (MMB511) ✓	998 (MMB511) ✓	999 (MMB511) *
642 (MMB527) ✓	332 (MMB527) ✓		
071 (S4) ✓	040 (S4) ✓		

Note: ✓ : Working
* : Not working
- : Unavailable

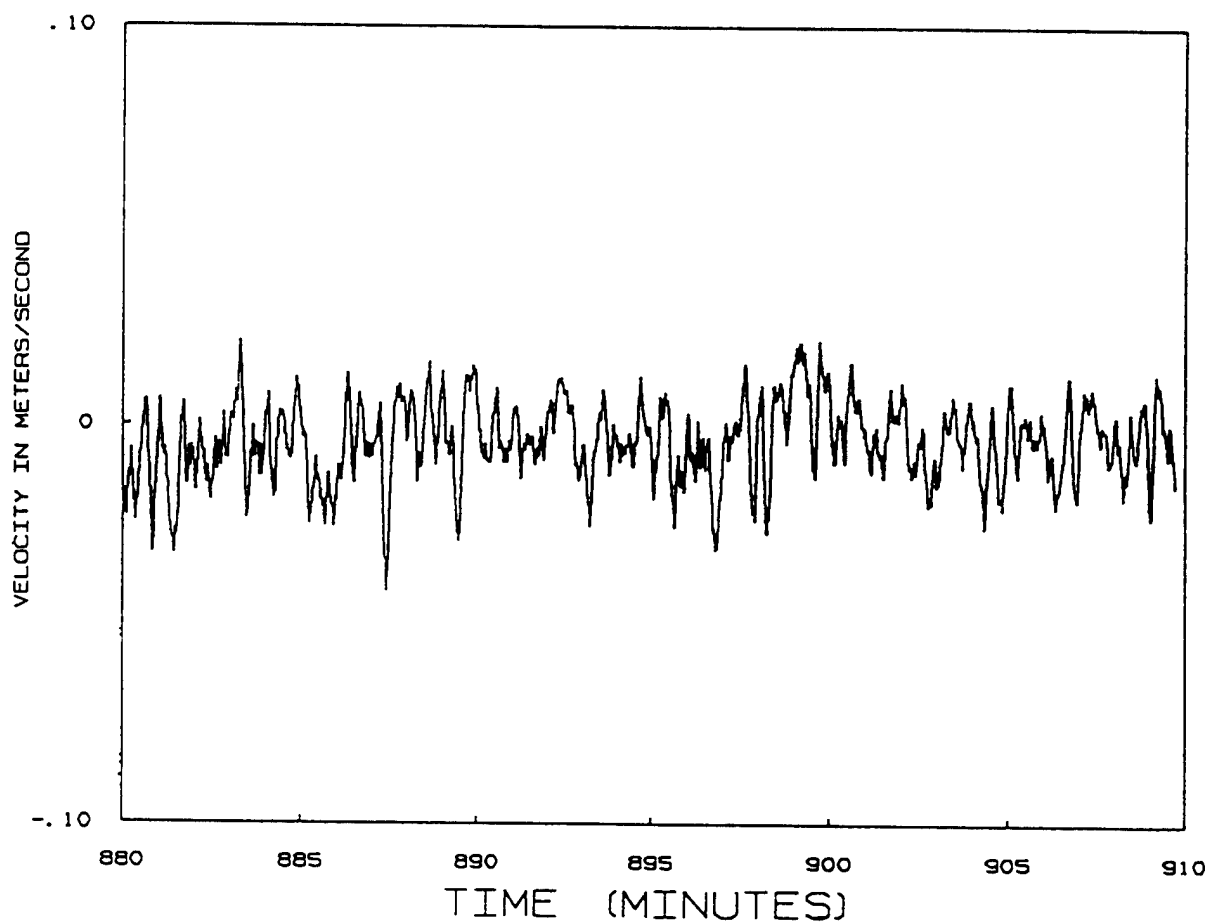
meter number	511-1001	start-time	1440
tow name	d.ray miller	end-time	1510
configuration	3x3+2x1	mean =	0.24
draft	7.1	vmax =	0.00 tmax = 896.
speed	4.9 mph	vmin =	0.00 tmin = 887.
direction	upstream		
distance	700		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



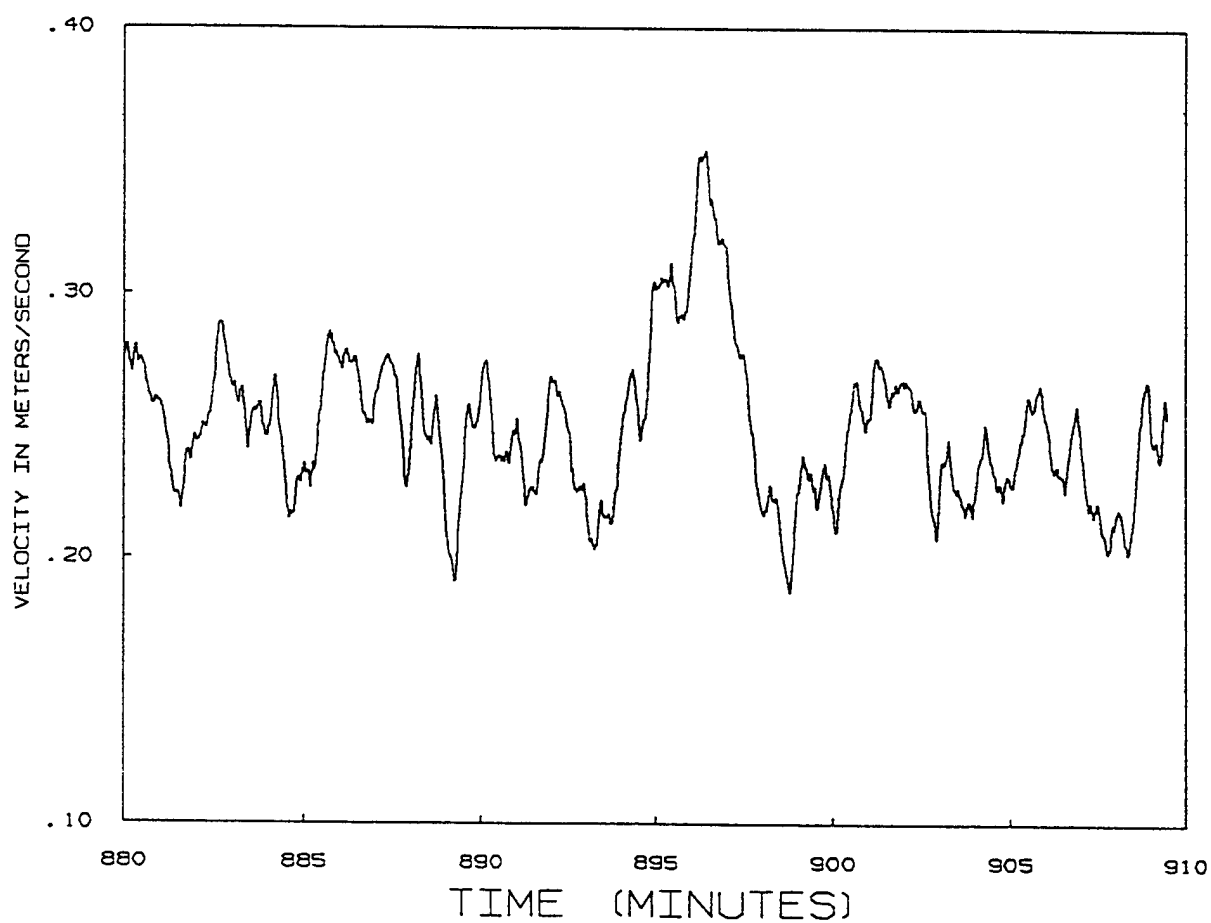
meter number	511-1001	start-time	1440
tow name	d.ray miller	end-time	1510
configuration	3x3+2x1	mean	= -0.01
draft	7.1	vmax	= 0.00 tmax = 900.
speed	4.9 mph	vmin	= 0.00 tmin = 887.
direction	upstream		
distance	700		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



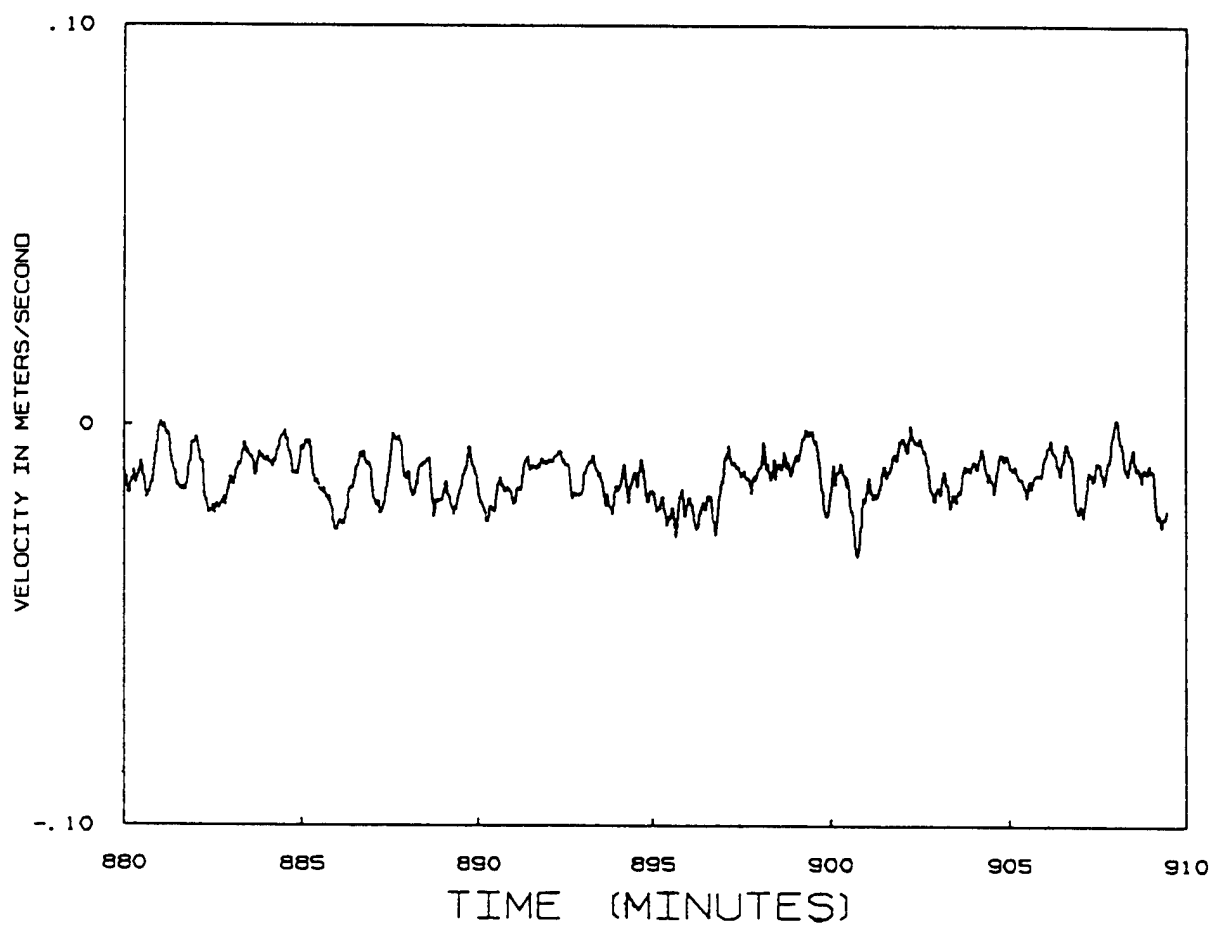
meter number	1000	distance	700
tow name	d.ray miller	start-time	1440
configuration	3x3+2x1	end-time	1510
draft	7.1	mean =	0.25
speed	4.9 mph	vmax =	0.35 tmax = 896.
direction	upstream	vmin =	0.19 tmin = 899.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



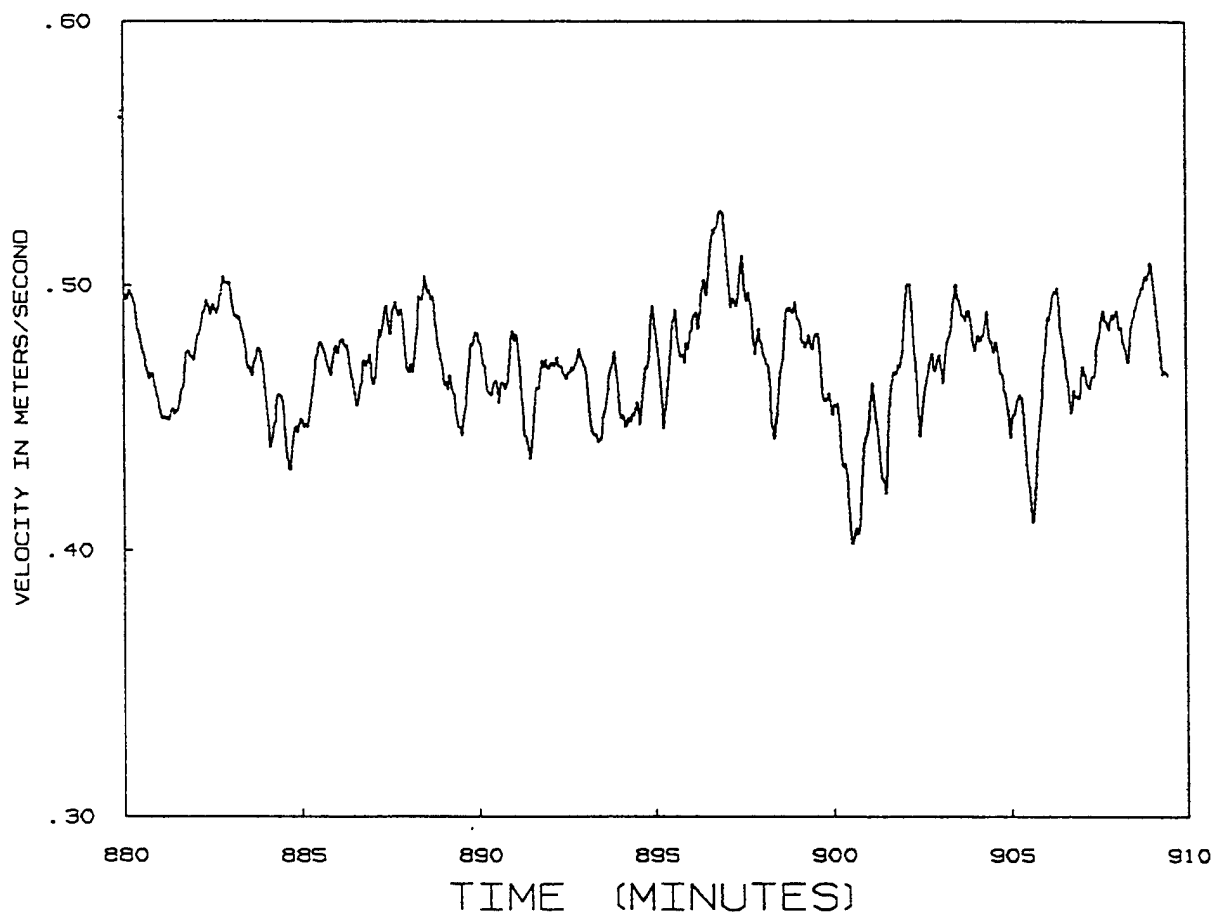
meter number	1000	distance	700
tow name	d.ray miller	start-time	1440
configuration	3x3+2x1	end-time	1510
draft	7.1	mean =	-0.01
speed	4.9 mph	vmax =	0.00 tmax = 908.
direction	upstream	vmin =	-0.03 tmin = 901.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



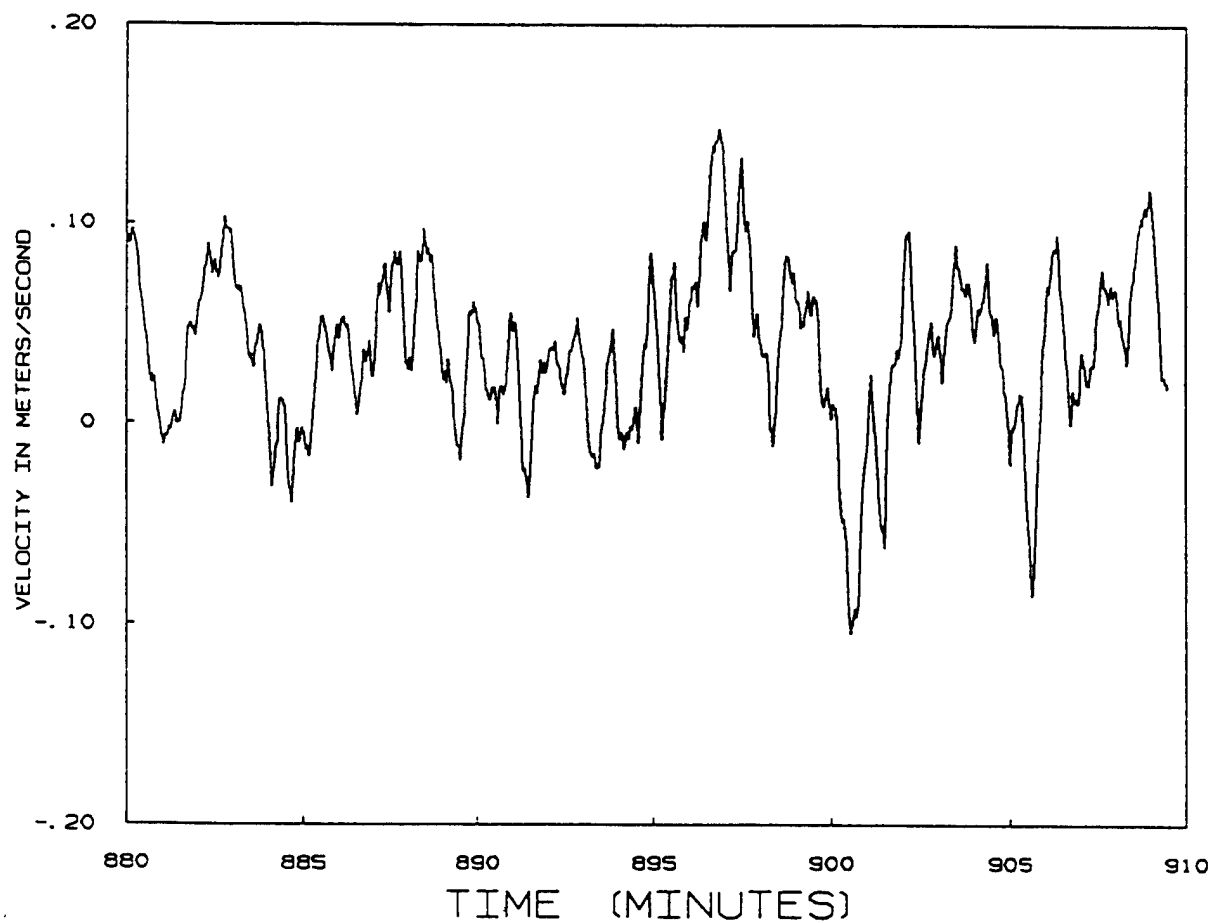
meter number	998	distance	700
tow name	d.ray miller	start-time	1440
configuration	3x3+2x1	end-time	1510
draft	7.1	mean =	0.47
speed	4.9 mph	vmax =	0.53 tmax = 897.
direction	upstream	vmmin =	0.40 tmin = 901.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



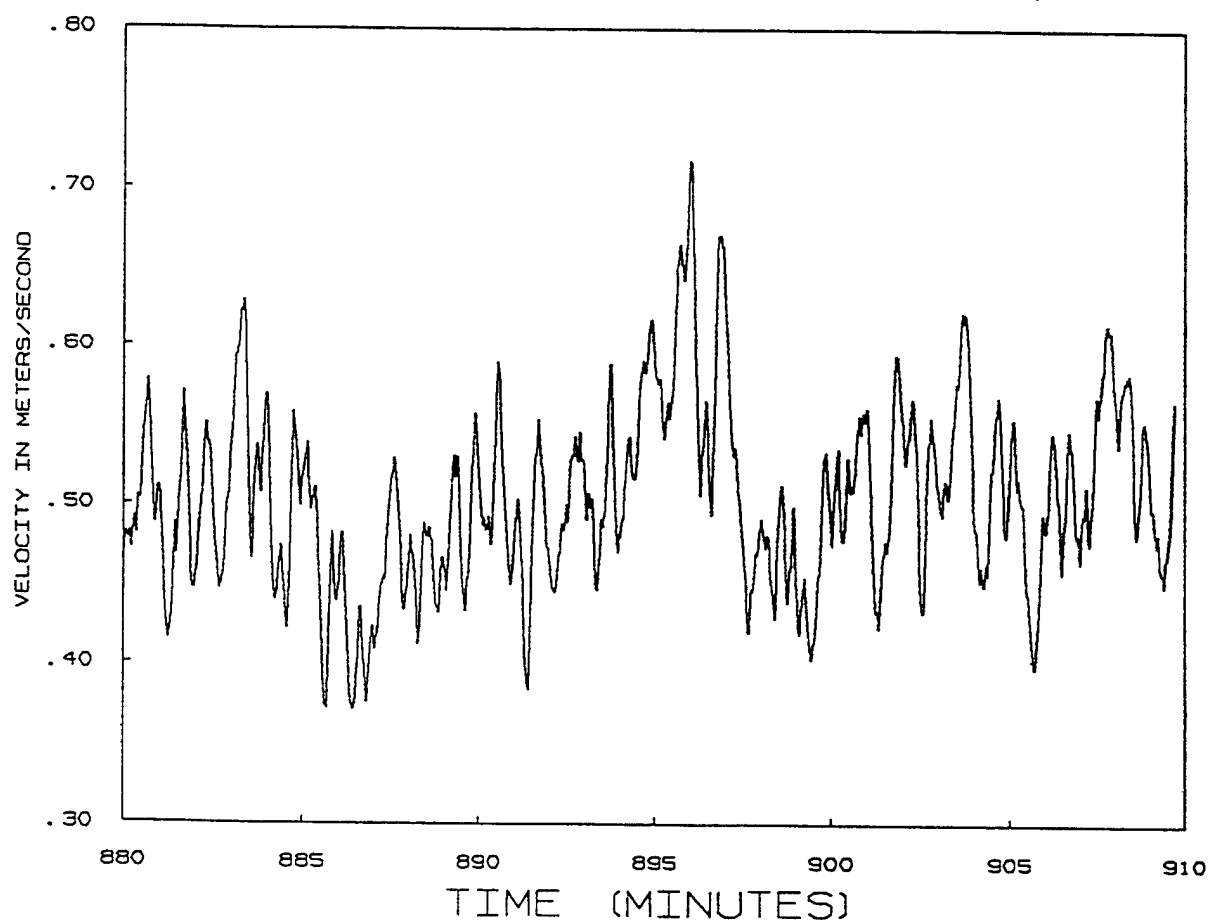
meter number	998	distance	700
tow name	d.ray miller	start-time	1440
configuration	3x3+2x1	end-time	1510
draft	7.1	mean =	0.04
speed	4.9 mph	vmax =	0.15 tmax = 897.
direction	upstream	vmin =	-0.10 tmin = 901.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



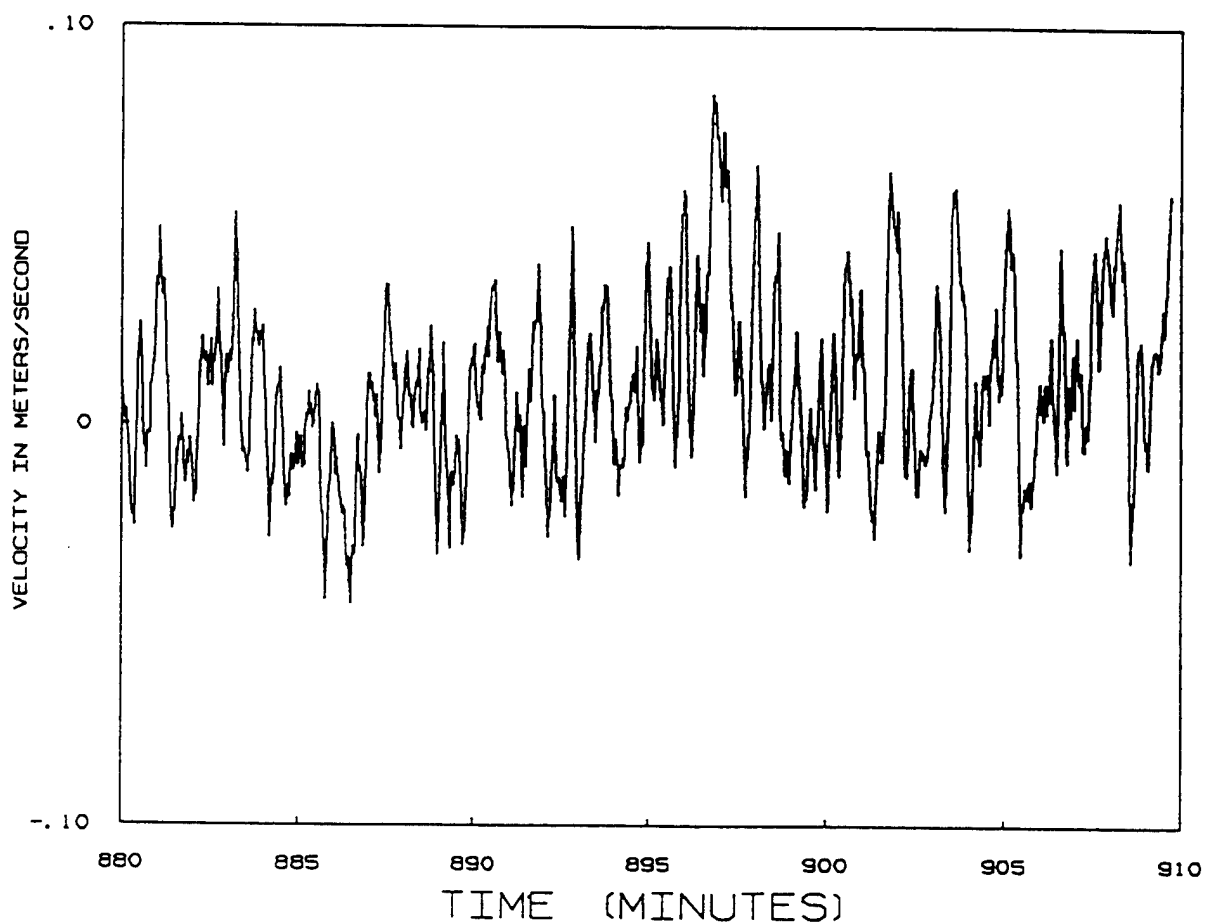
meter number	B-642	start-time	1440
tow name	d.ray miller	end-time	1510
configuration	3x3+2x1	mean =	0.48
draft	7.1	vmax =	0.00 tmax = 896.
speed	4.9 mph	vmin =	0.00 tmin = 886.
direction	upstream		
distance	700		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



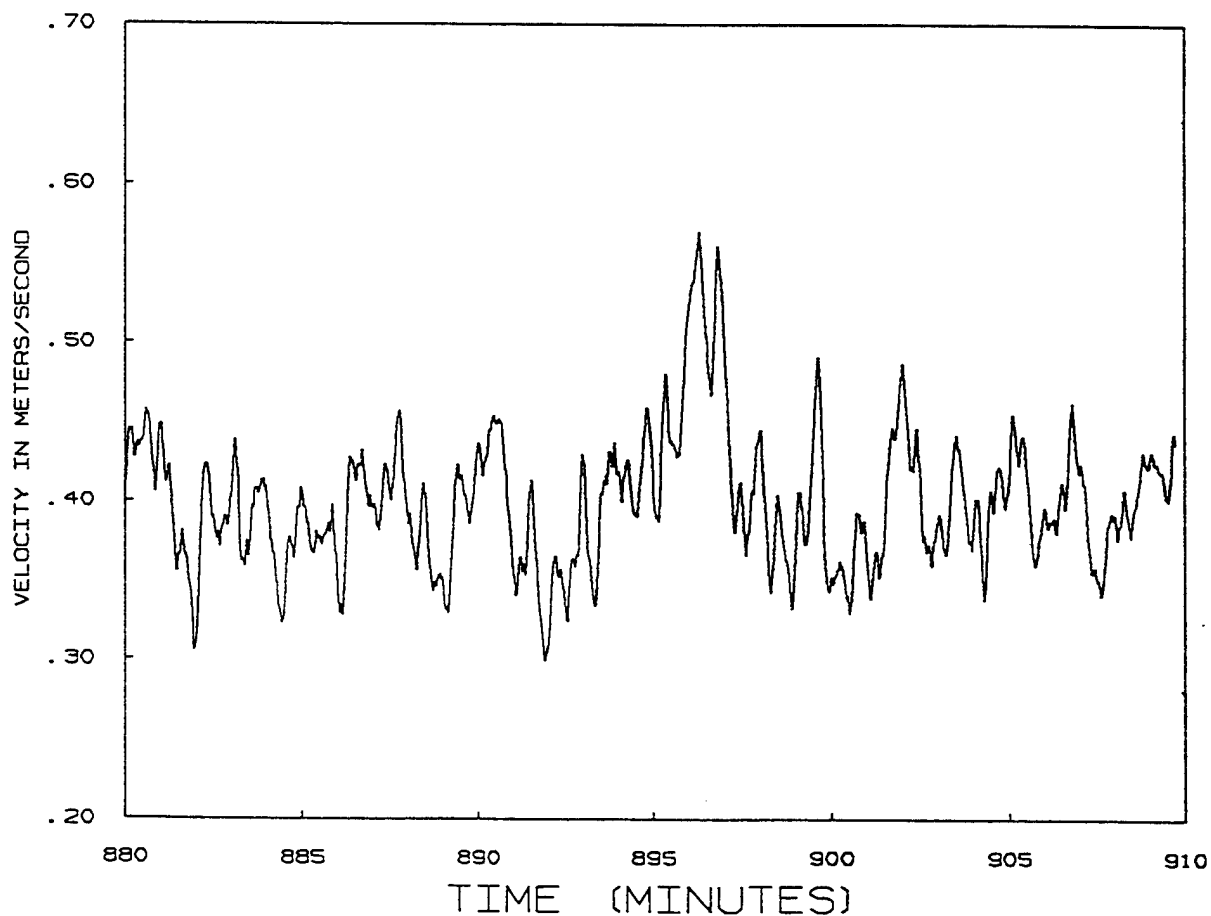
meter number	B-642	start-time	1440
tow name	d.ray miller	end-time	1510
configuration	3x3+2x1	mean =	0.00
draft	7.1	vmax =	0.00 tmax = 897.
speed	4.9 mph	vmin =	0.00 tmin = 886.
direction	upstream		
distance	700		

MARSH MCBIRNEY S11/S27 PLOTTING ROUTINE Y - COMPONENT



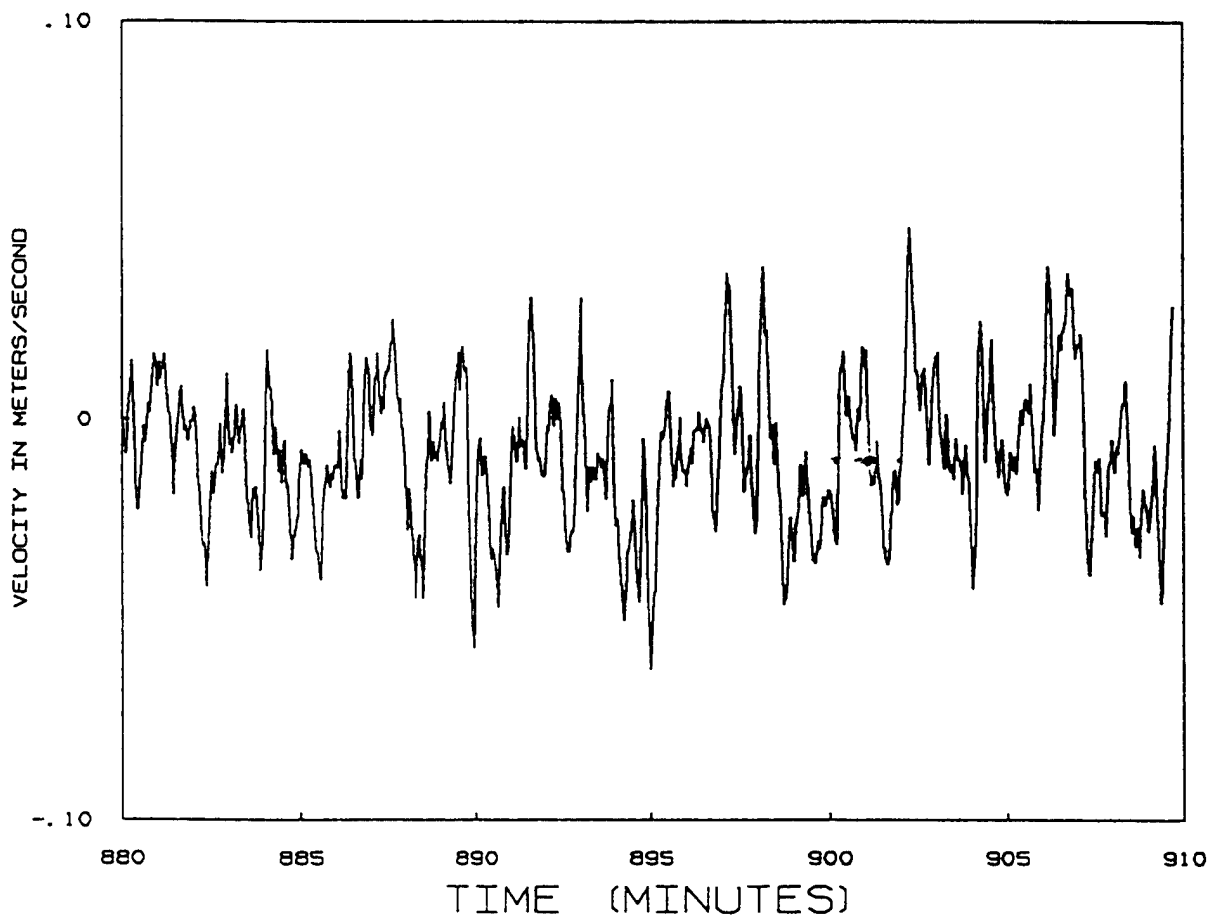
meter number	B-332	start-time	1440
tow name	d.ray miller	end-time	1510
configuration	3x3+2x1	mean =	0.39
draft	7.1	vmax =	0.00 tmax = 896.
speed	4.9 mph	vmin =	0.00 tmin = 892.
direction	upstream		
distance	700		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT

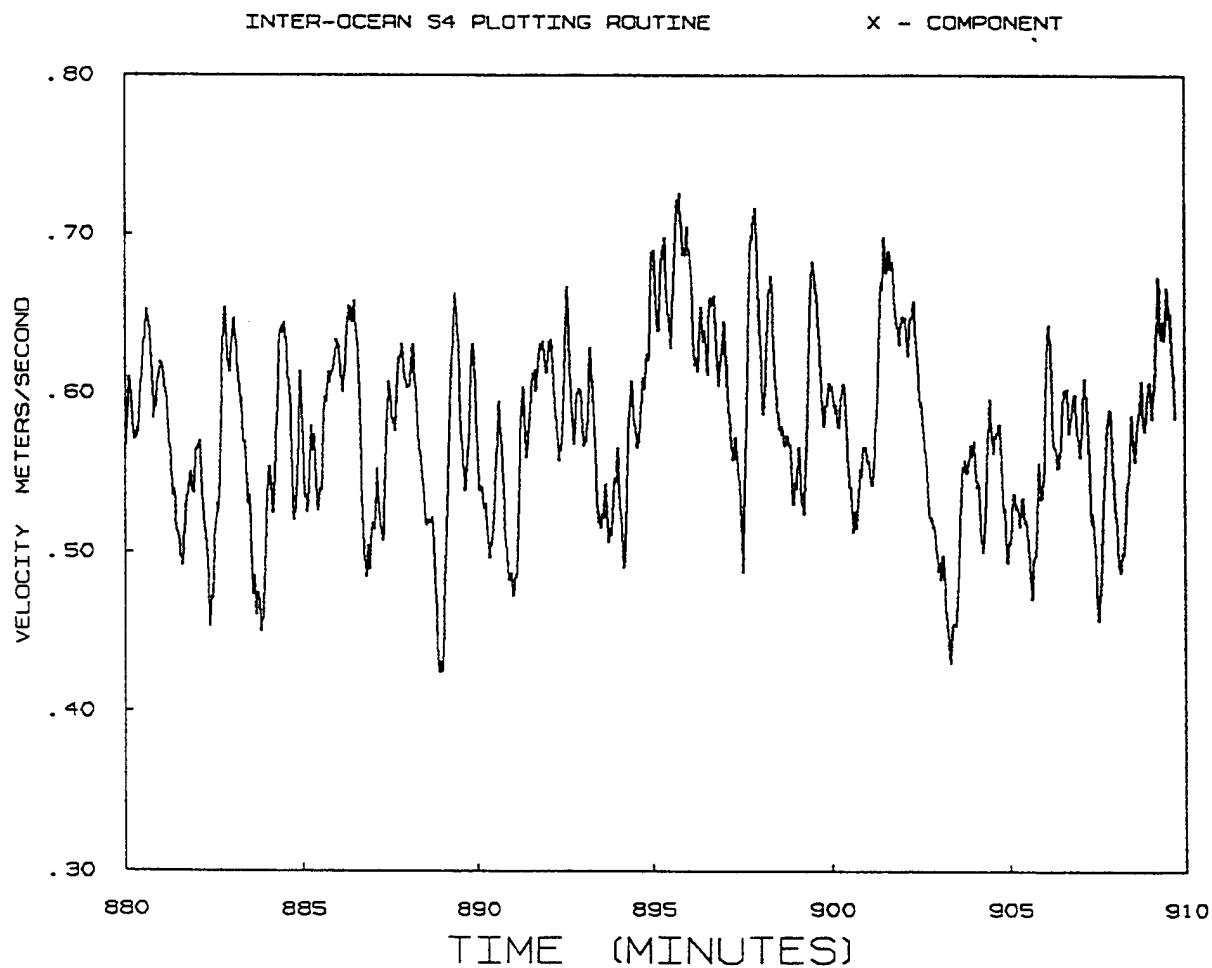


meter number	B-332	start-time	1440
tow name	d.ray miller	end-time	1510
configuration	3x3+2x1	mean	= -0.01
draft	7.1	vmax	= 0.00 tmax = 902.
speed	4.9 mph	vmin	= 0.00 tmin = 895.
direction	upstream		
distance	700		

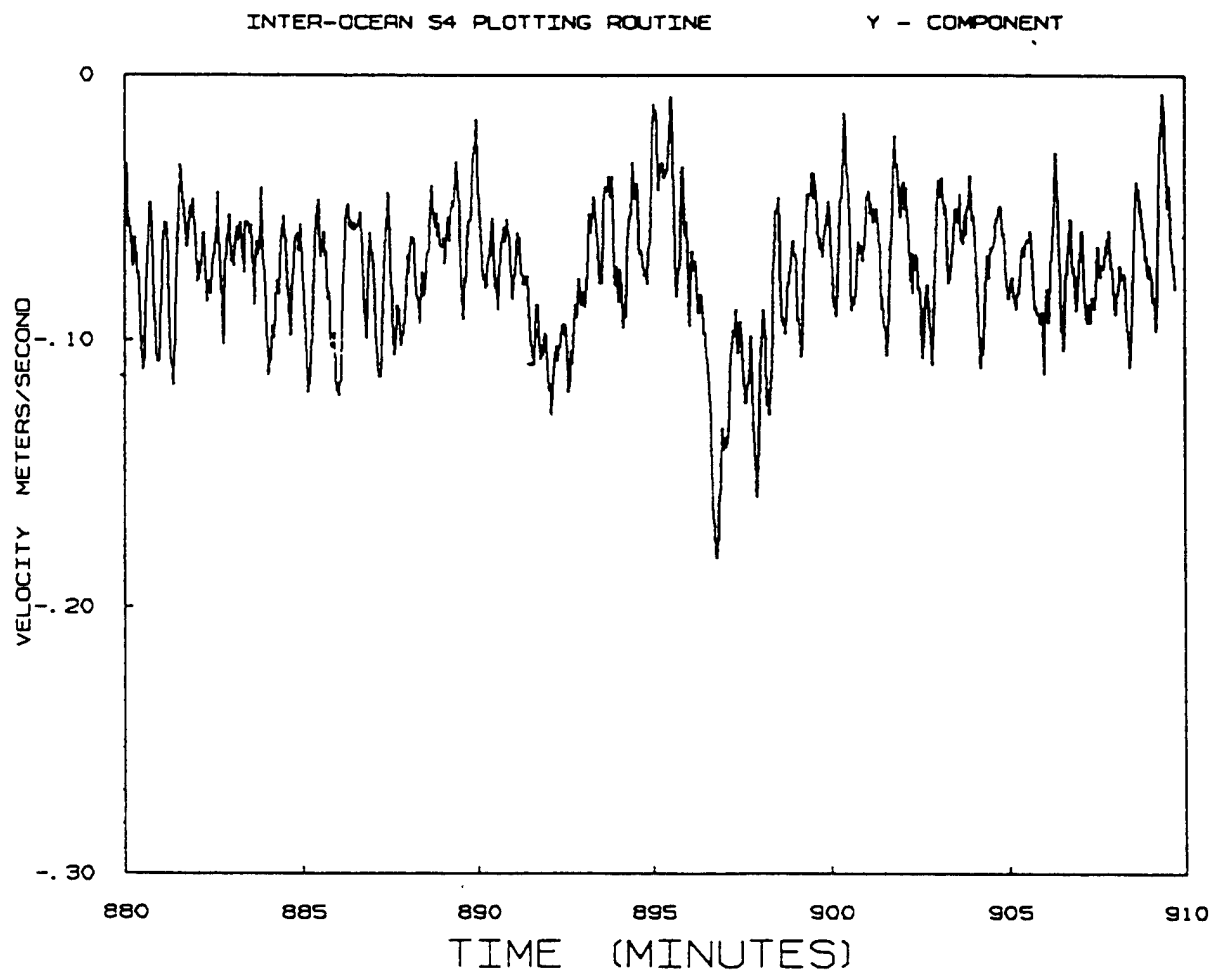
MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



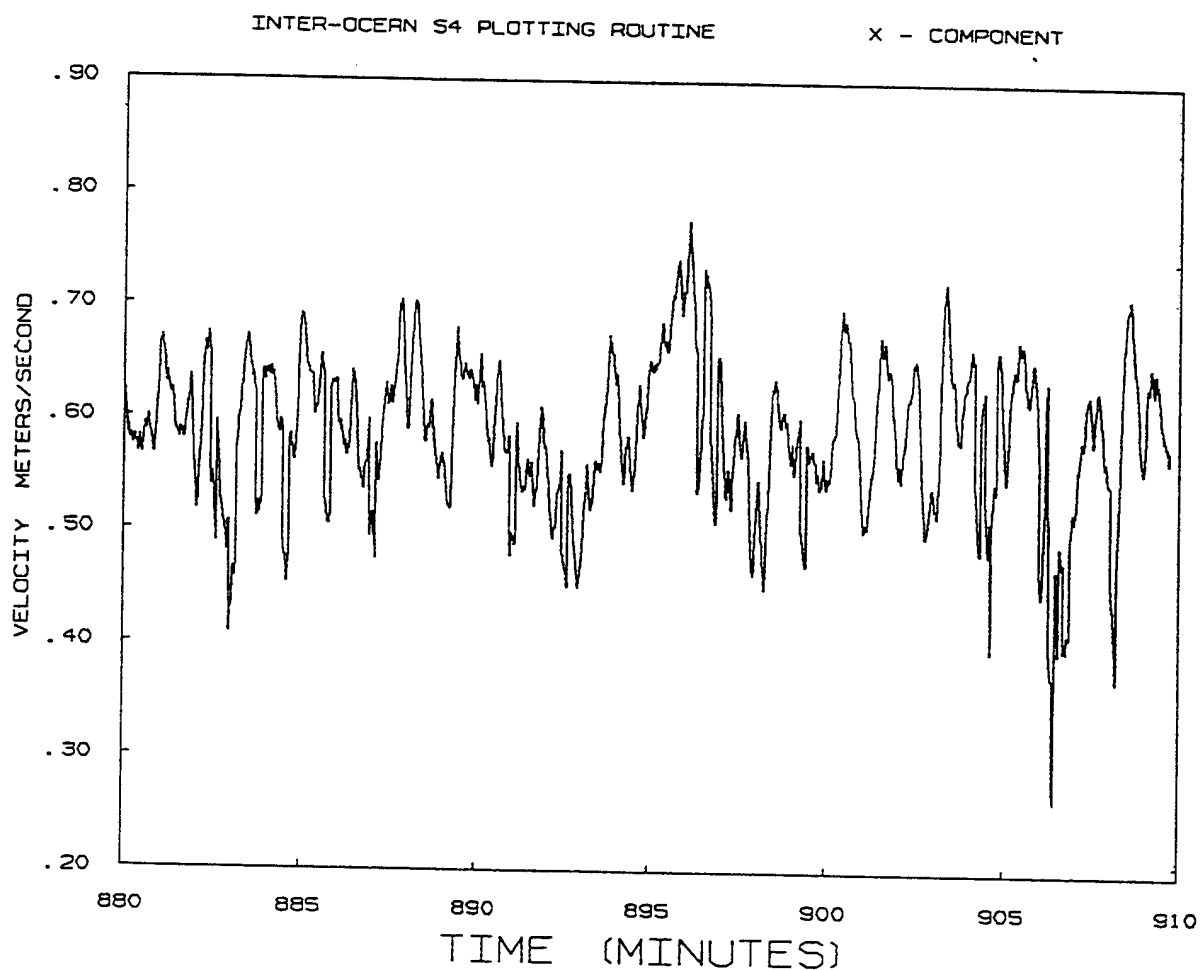
meter number	071	distance	700
tow name	d. ray miller	start-time	1440
configuration	3x3+2x1	end-time	1510
draft	7.1	MEAN =	0.57
speed	4.9 mph	VMAX =	0.73 TMAX = 896.
direction	upstream	VMIN =	0.42 TMIN = 889.



meter number	071	distance	700
tow name	d. ray miller	start-time	1440
configuration	3x3+2x1	end-time	1510
draft	7.1	MEAN	= -0.07
speed	4.9 mph	VMAX	= -0.01 TMAX = 909.
direction	upstream	VMIN	= -0.18 TMIN = 897.



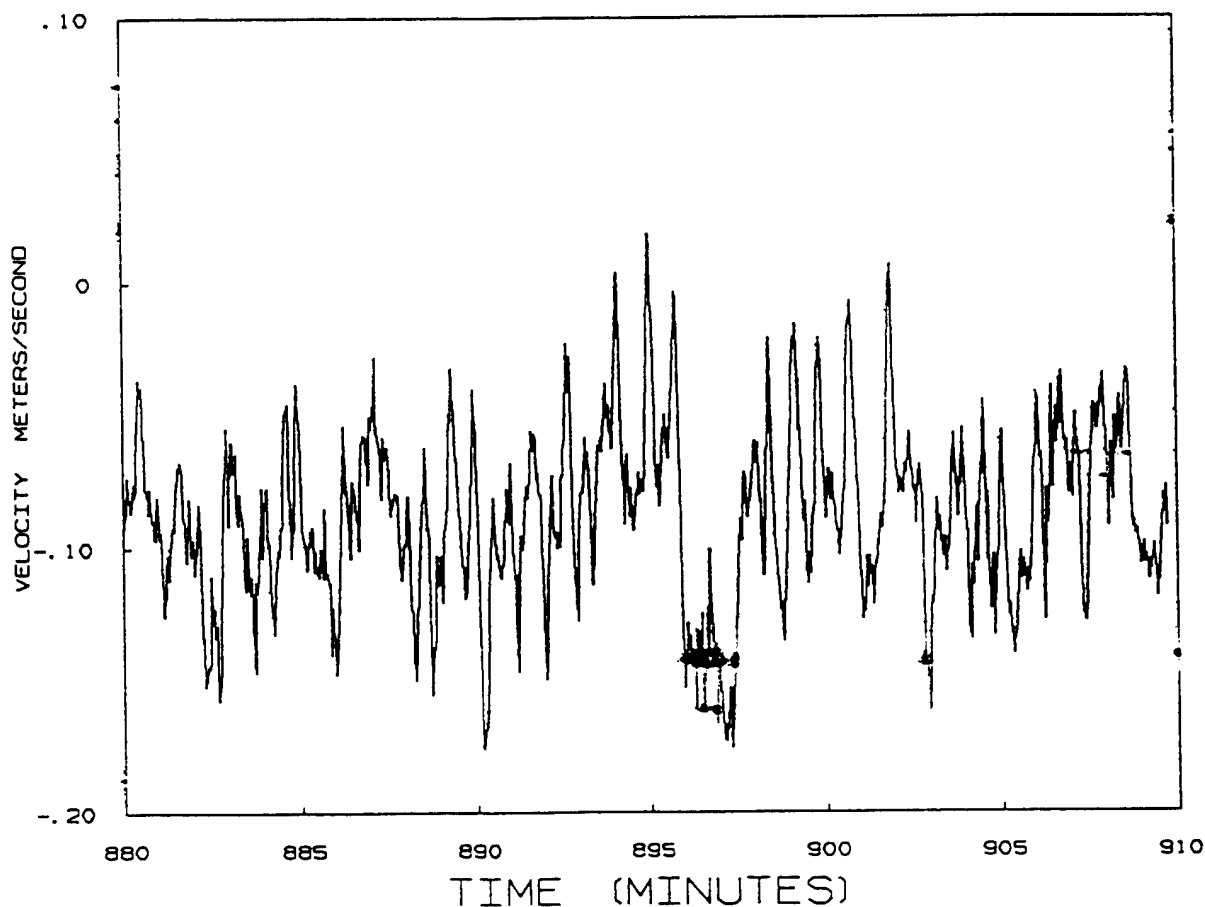
meter number	040	distance	700
tow name	d. ray miller	start-time	1440
configuration	3x3+2x1	end-time	1510
draft	7.1	MEAN =	0.60
speed	4.9 mph	VMAX =	0.78 TMAX = 896.
direction	upstream	VMIN =	0.26 TMIN = 906.



meter number	040	distance	700
tow name	d. ray miller	start-time	1440
configuration	3x3+2x1	end-time	1510
draft	7.1	MEAN =	-0.09
speed	4.9 mph	VMAX =	0.02 TMAX = 895.
direction	upstream	VMIN =	-0.18 TMIN = 890.

INTER-OCEAN S4 PLOTTING ROUTINE

Y - COMPONENT



XX-3. Velocity fluctuations measured by two-dimensional current meters
for barge *Hugh C. Blaske* at Goose Island, trip 1

Hugh C. Blaske (8/25/90)

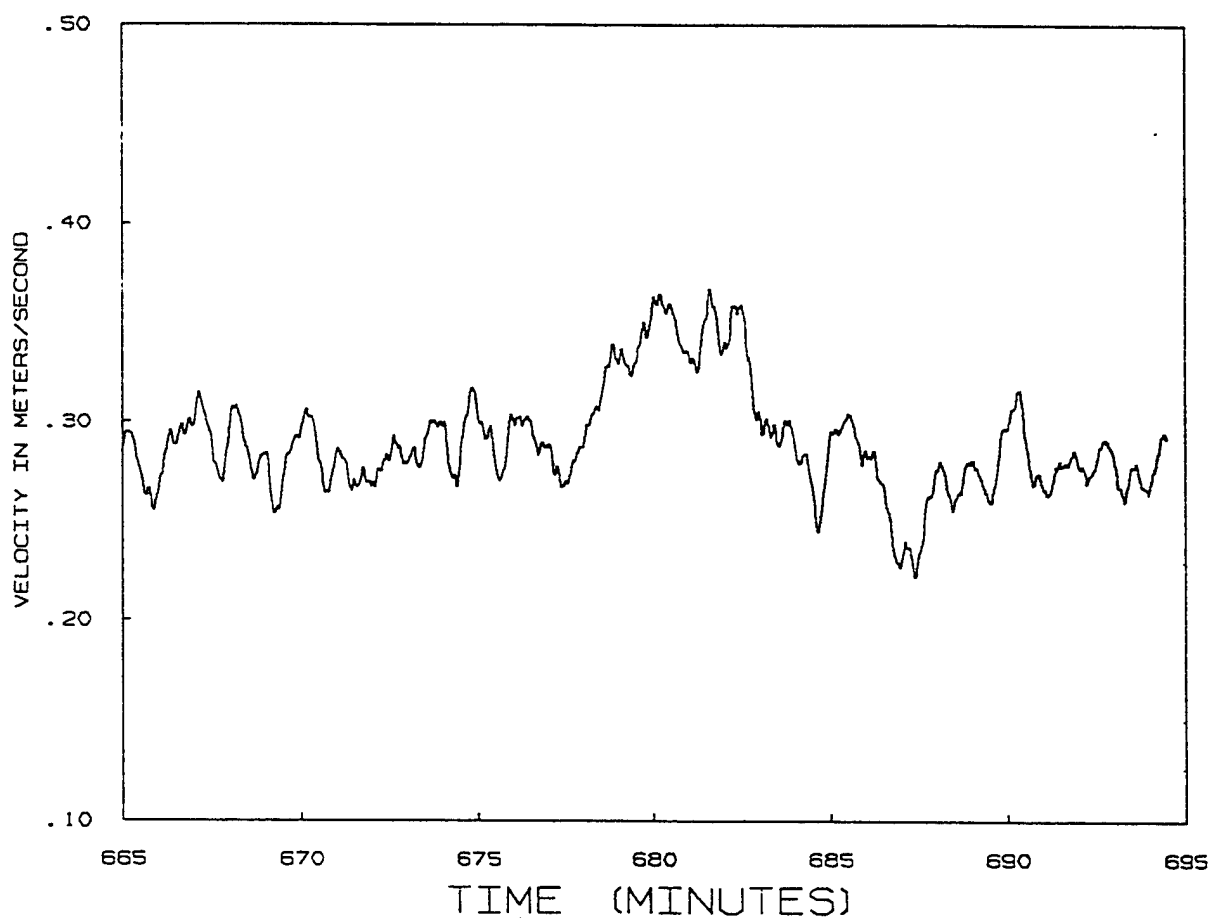
Status of Electromagnetic Current Meters:

1000 (MMB511) √	998 (MMB511) √	999 (MMB511) √	1001 (MMB511) √
642 (MMB527) √	332 (MMB527) √		
040 (S4) √	071 (S4) √		

Note: √ : Working
* : Not working
- : Unavailable

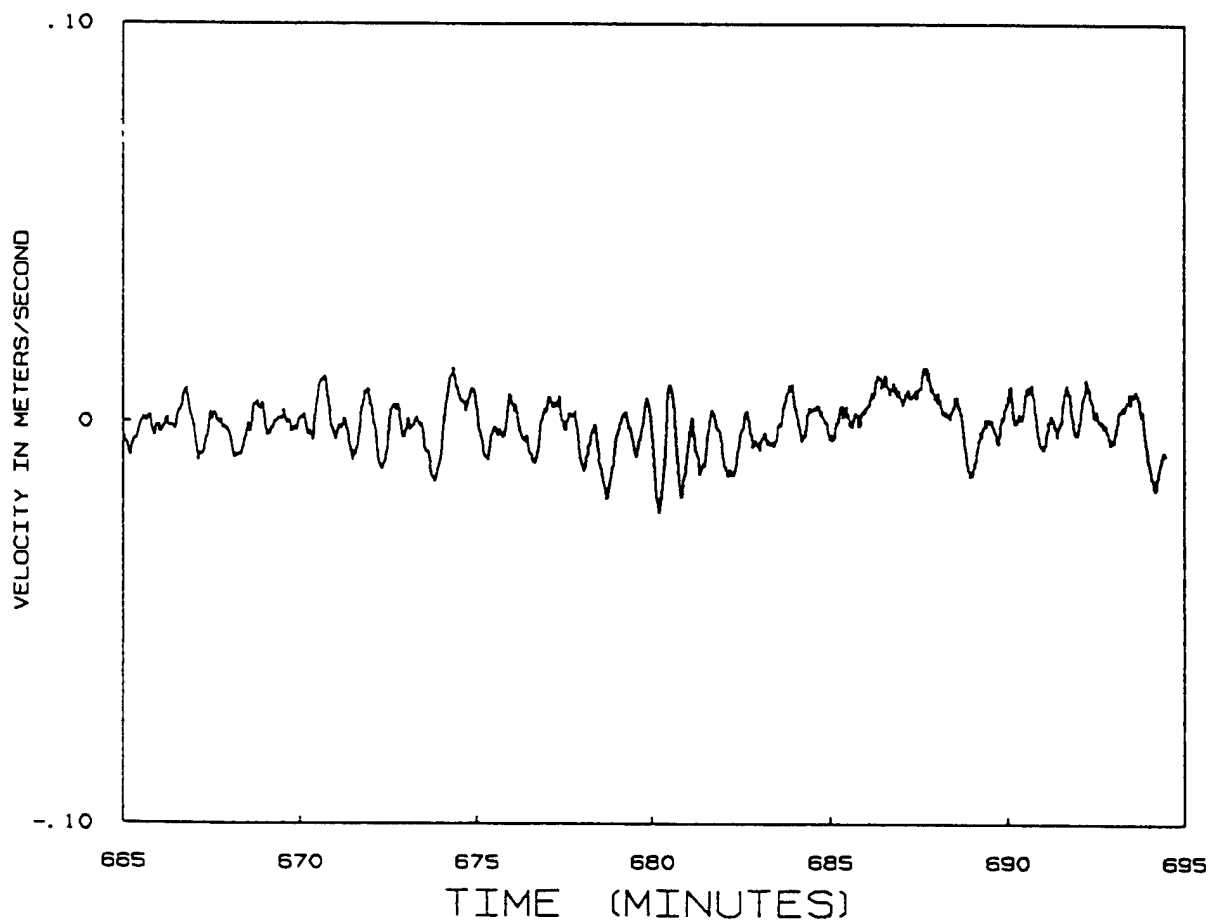
meter number	1000	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	mean =	0.28
speed	4.2 mph	vmax =	0.37 tmax = 682.
direction	upstream	vmin =	0.22 tmin = 687.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



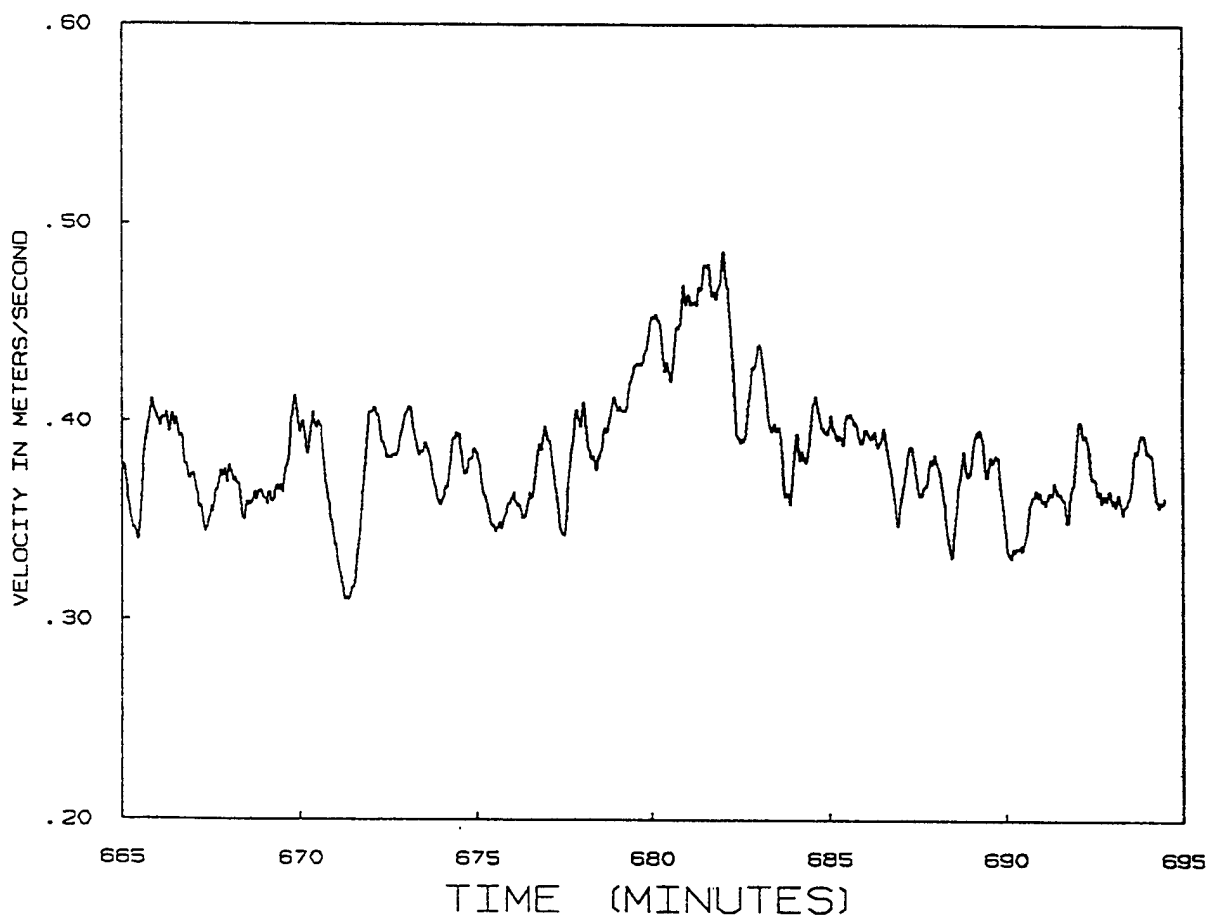
meter number	1000	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	mean =	0.00
speed	4.2 mph	vmax =	0.01 tmax = 688.
direction	upstream	vmin =	-0.02 tmin = 680.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



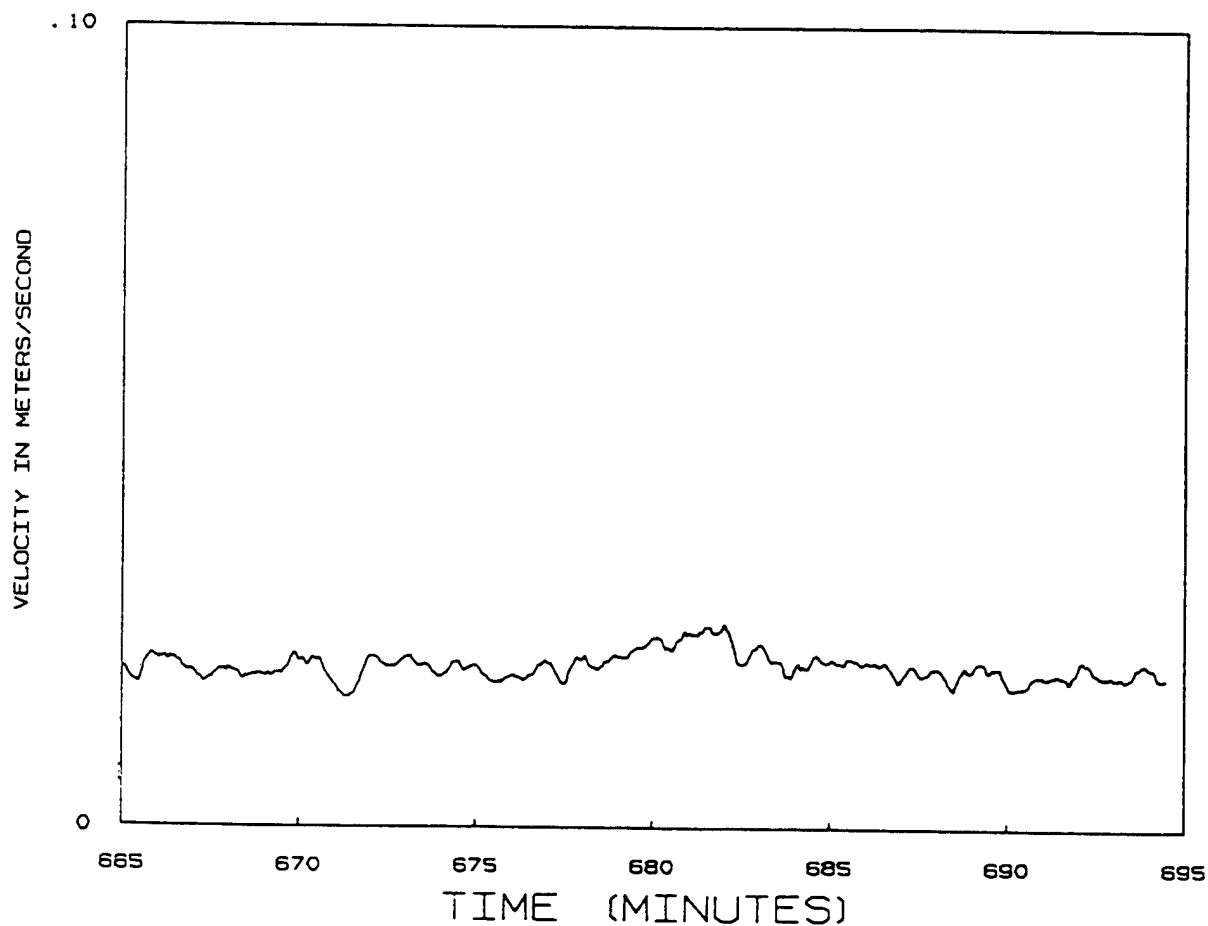
meter number	998	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	mean =	0.37
speed	4.2 mph	vmax =	0.49 tmax = 682.
direction	upstream	vmin =	0.31 tmin = 671.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



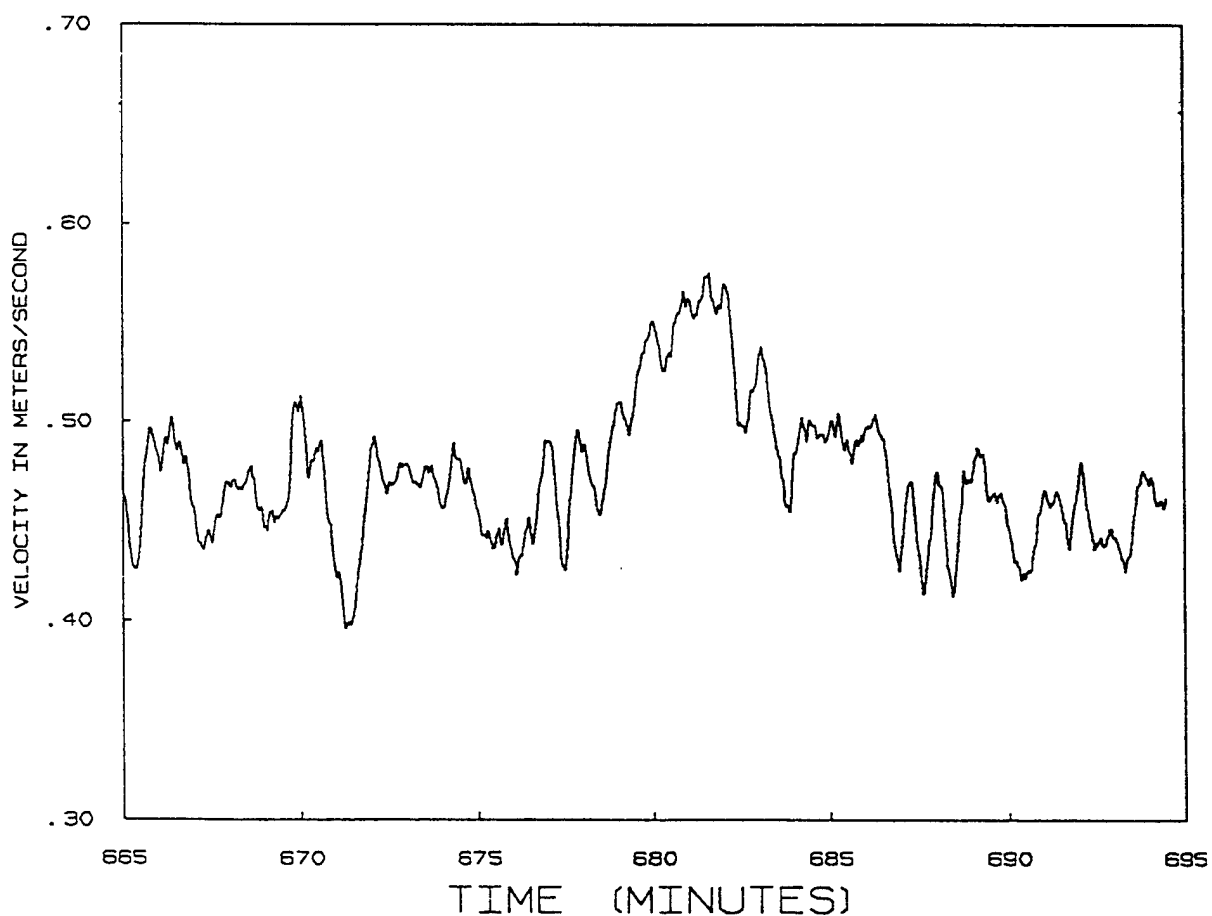
meter number	998	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	mean =	0.02
speed	4.2 mph	vmax =	0.03 tmax = 682.
direction	upstream	vmin =	0.02 tmin = 671.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



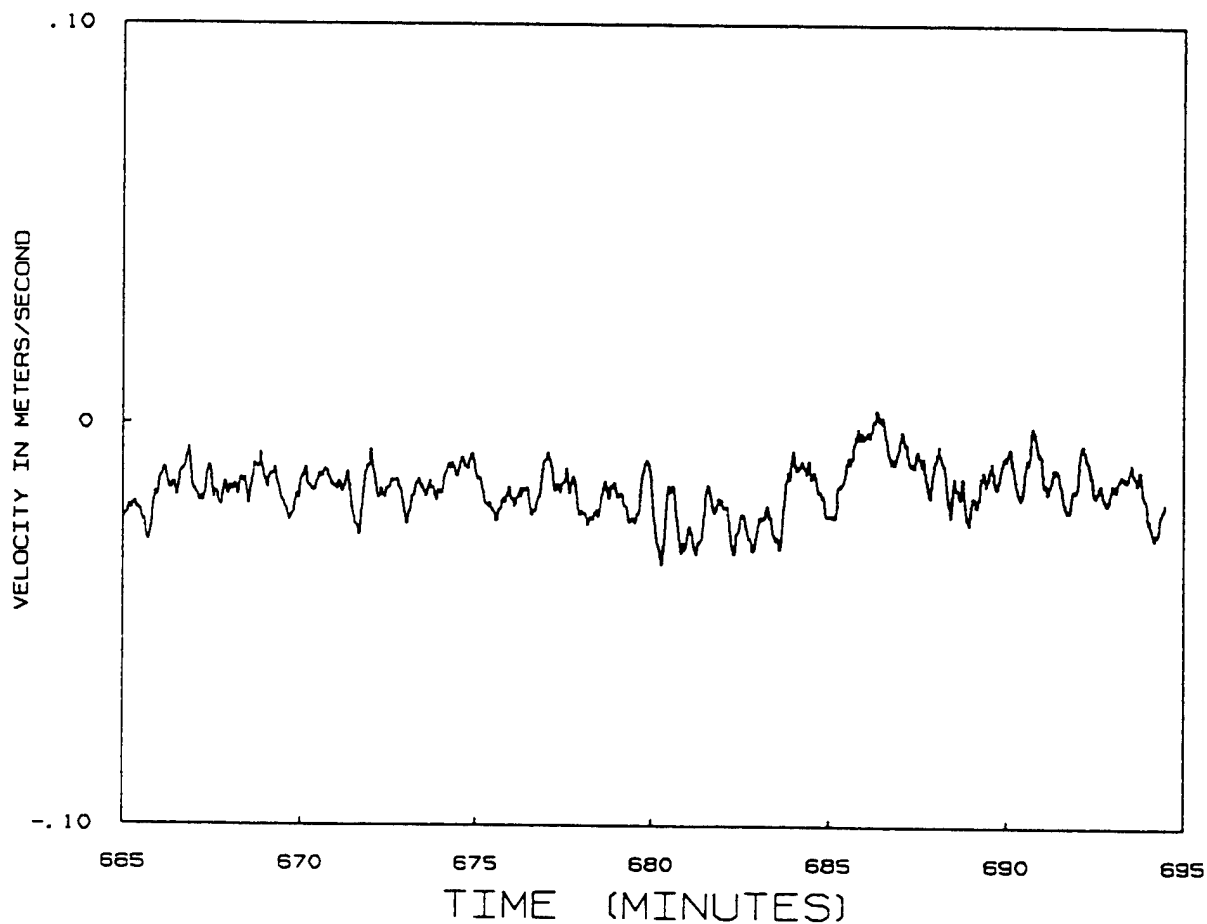
meter number	999	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	mean =	0.46
speed	4.2 mph	vmax =	0.58 tmax = 682.
direction	upstream	vmin =	0.40 tmin = 671.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



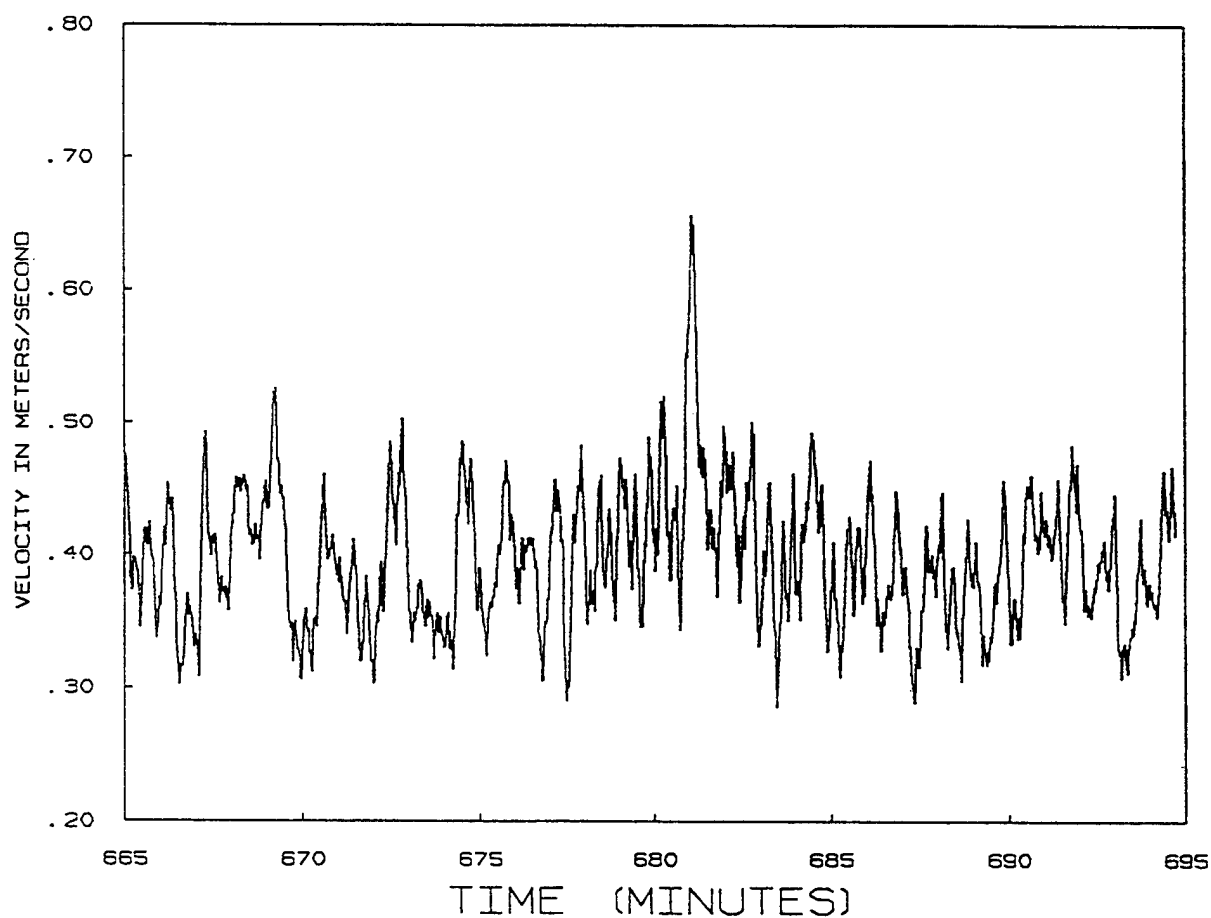
meter number	999	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	mean =	-0.02
speed	4.2 mph	vmax =	0.00 tmax = 686.
direction	upstream	vmin =	-0.03 tmin = 680.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



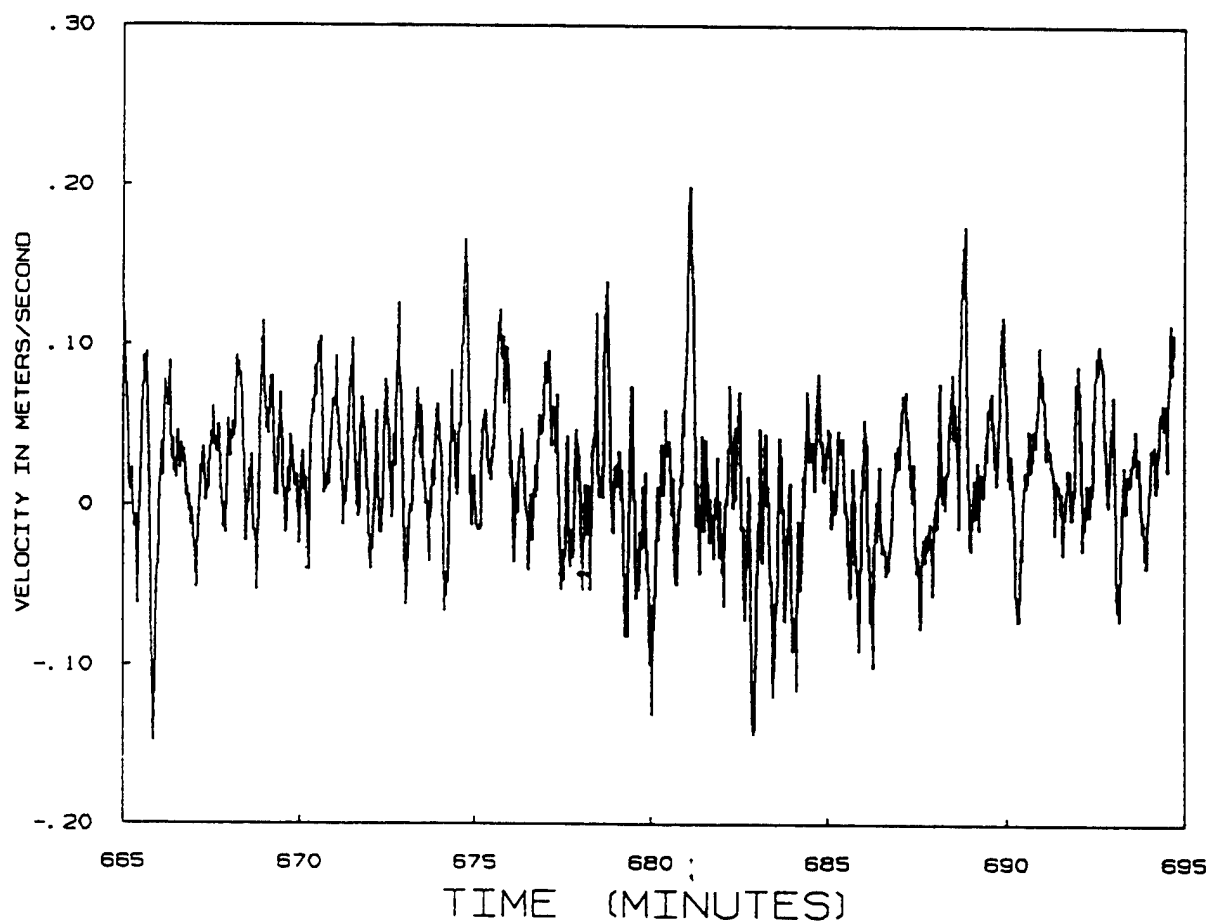
meter number	511-1001	start-time	1105
tow name	hugh c.	end-time	1135
configuration	3x5	mean =	0.39
draft	8.5	vmax =	0.00 tmax = 681.
speed	4.2 mph	vmin =	0.00 tmin = 683.
direction	upstream		
distance	310		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



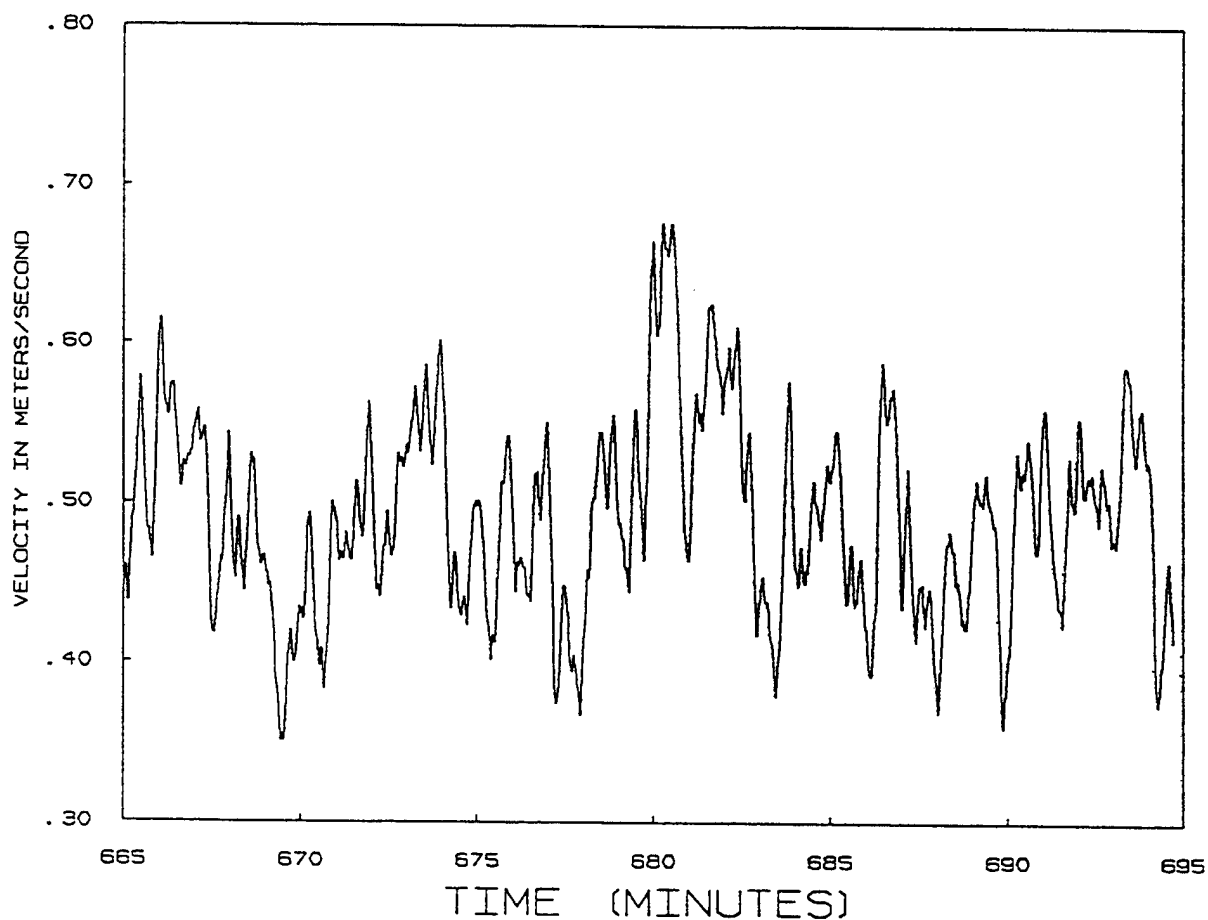
meter number	511-1001	start-time	1105
tow name	hugh c.	end-time	1135
configuration	3x5	mean =	0.03
draft	8.5	vmax =	0.00 tmax = 681.
speed	4.2 mph	vmin =	0.00 tmin = 666.
direction	upstream		
distance	310		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



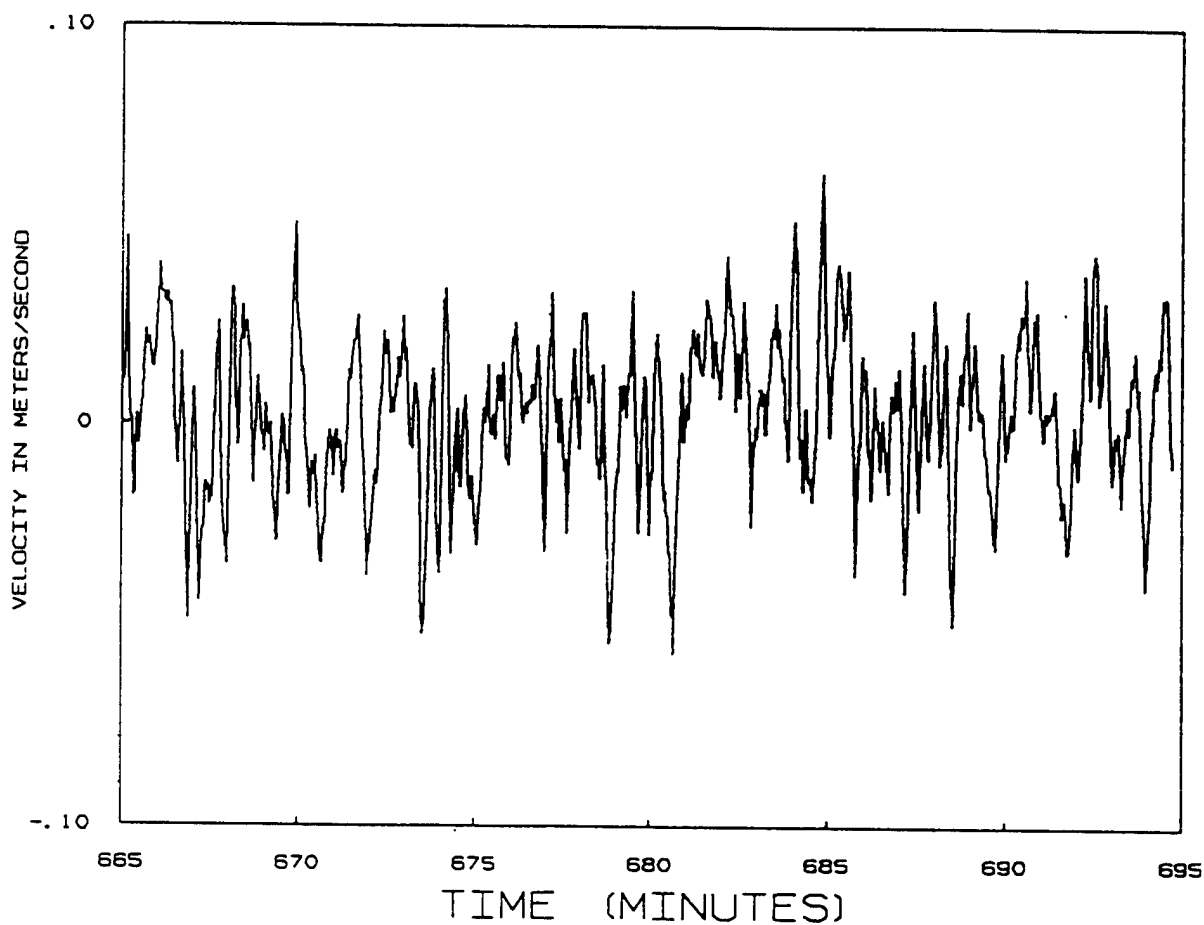
meter number	B-642	start-time	1105
tow name	hugh c.	end-time	1135
configuration	3x5	mean =	0.49
draft	8.5	vmax =	0.00 tmax = 680.
speed	4.2 mph	vmin =	0.00 tmin = 670.
direction	upstream		
distance	310		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



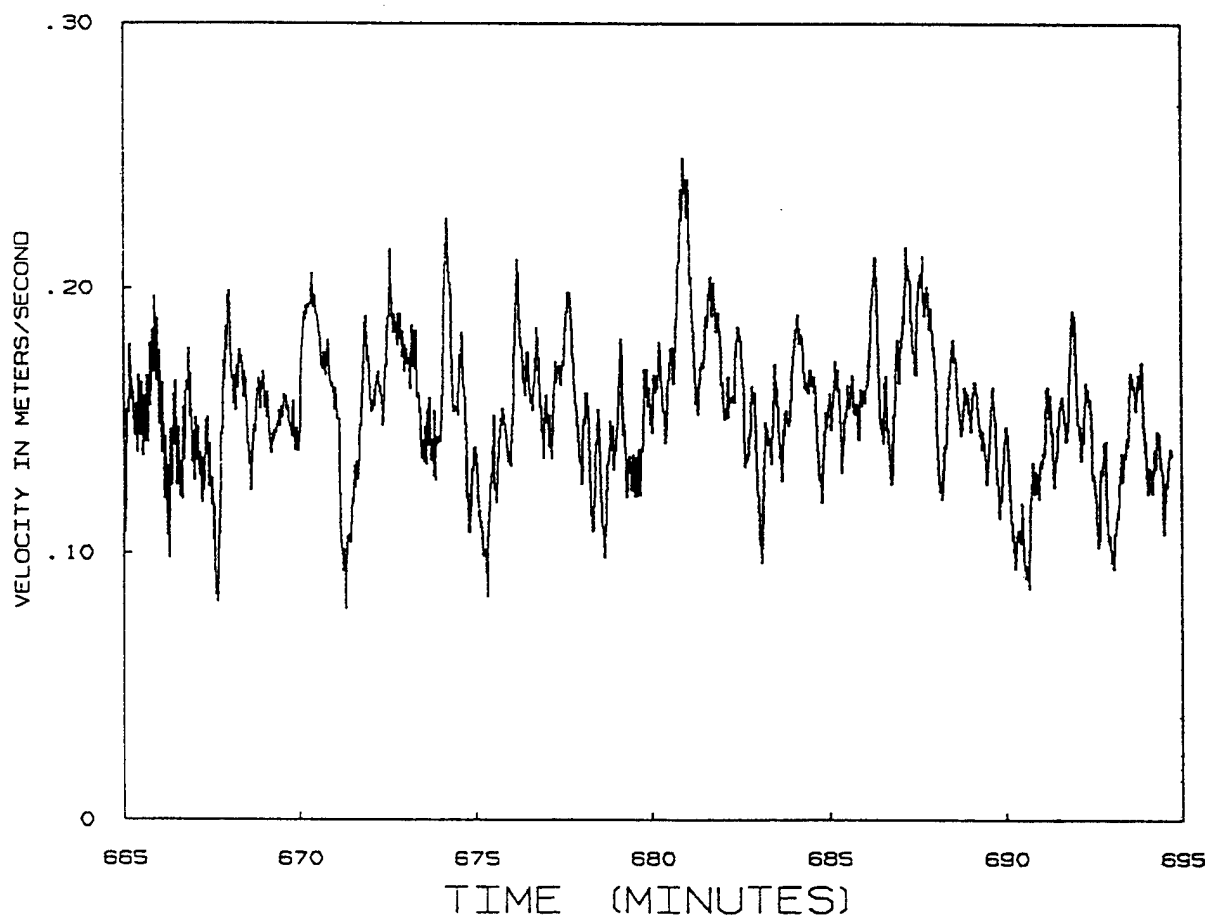
meter number	B-642	start-time	1105
tow name	hugh c.	end-time	1135
configuration	3x5	mean =	0.00
draft	8.5	vmax =	0.00 tmax = 685.
speed	4.2 mph	vmin =	0.00 tmin = 681.
direction	upstream		
distance	310		

MARSH MCBIRNEY S11/527 PLOTTING ROUTINE Y - COMPONENT



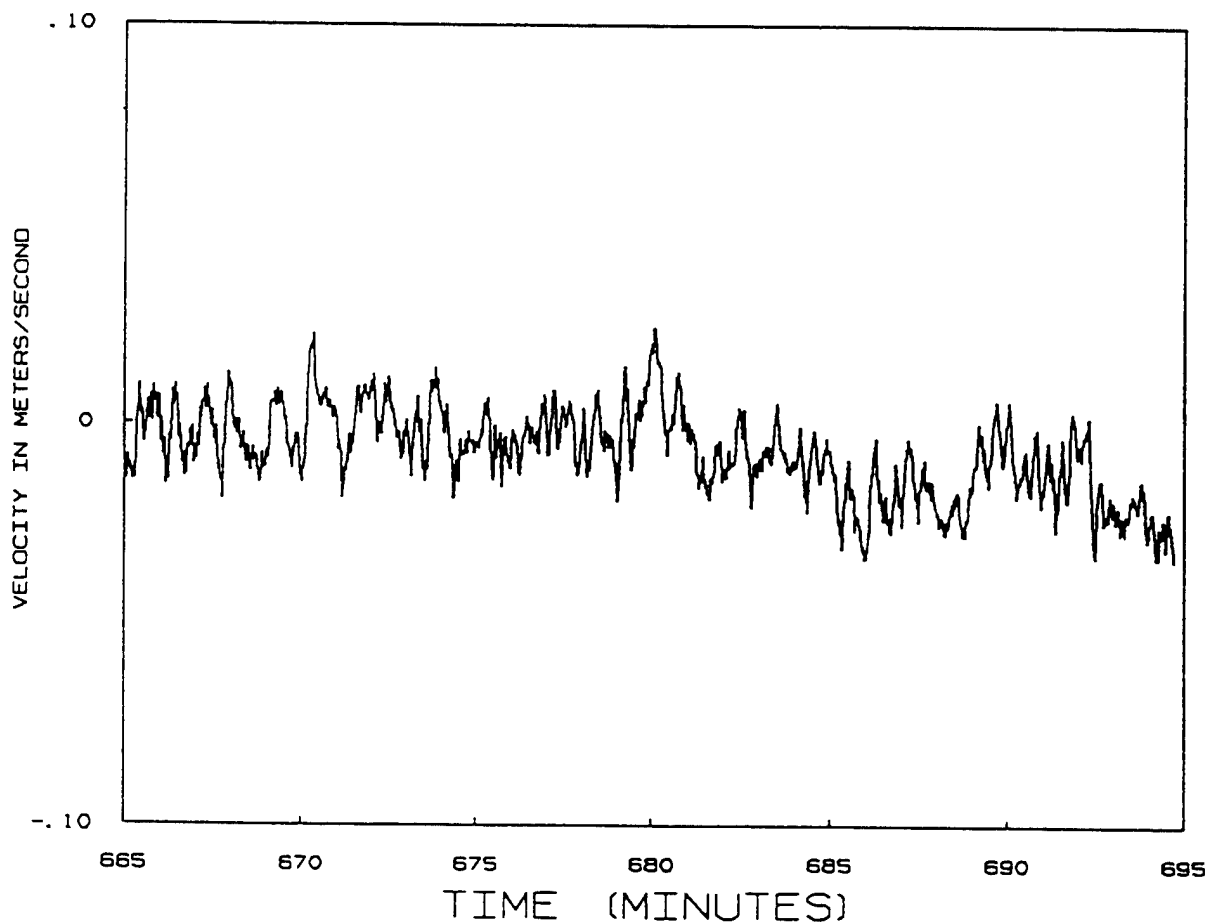
meter number	B-332	start-time	1105
tow name	hugh c.	end-time	1135
configuration	3x5	mean =	0.15
draft	8.5	vmax =	0.00 tmax = 681.
speed	4.2 mph	vmin =	0.00 tmin = 671.
direction	upstream		
distance	310		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT

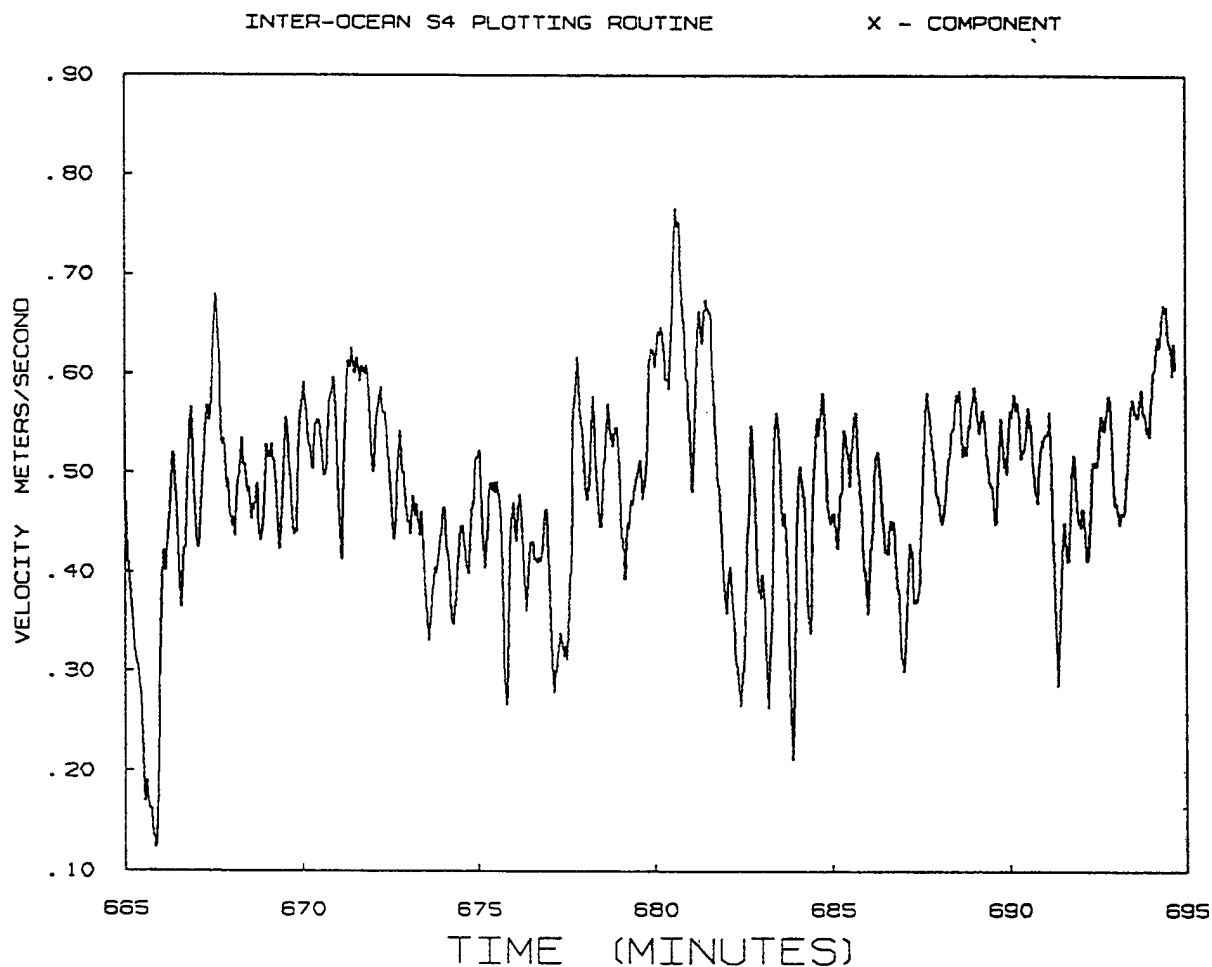


meter number	B-332	start-time	1105
tow name	hugh c.	end-time	1135
configuration	3x5	mean =	0.00
draft	8.5	vmax =	0.00 tmax = 680.
speed	4.2 mph	vmin =	0.00 tmin = 695.
direction	upstream		
distance	310		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



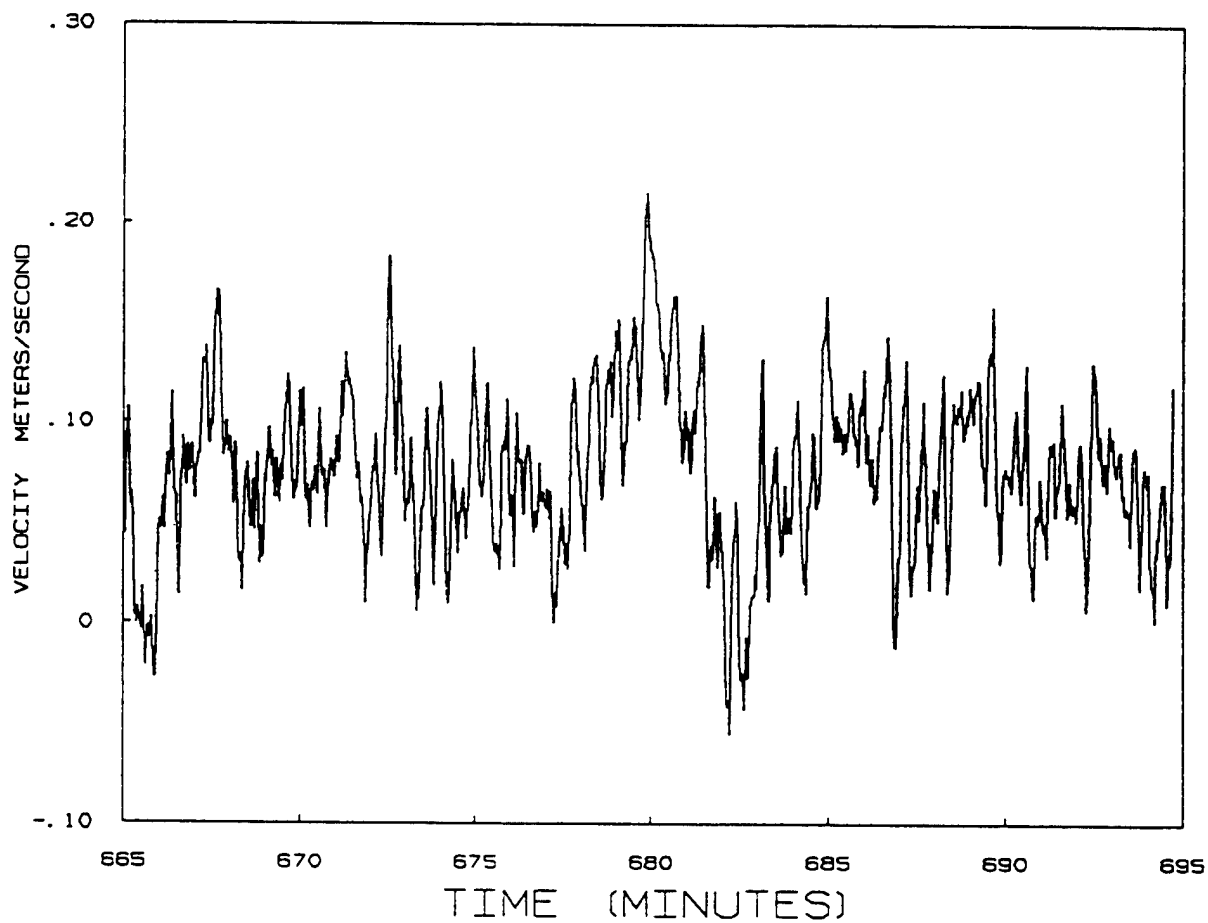
meter number	040	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	MEAN =	0.47
speed	4.2 mph	VMAX =	0.77 TMAX = 681.
direction	upstream	VMIN =	0.12 TMIN = 666.



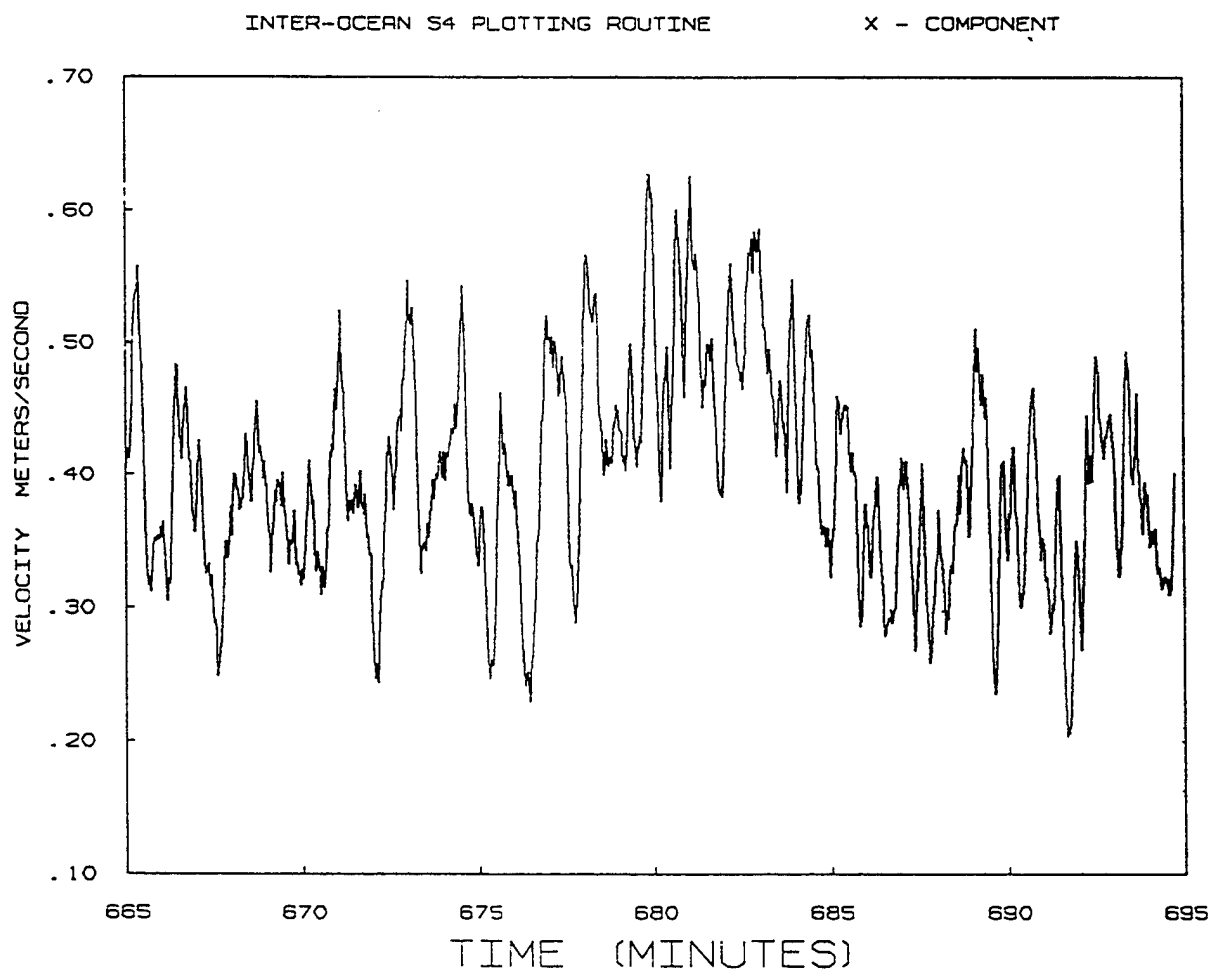
meter number	040	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	MEAN =	0.07
speed	4.2 mph	VMAX =	0.22 TMAX = 680.
direction	upstream	VMIN =	-0.06 TMIN = 682.

INTER-OCEAN S4 PLOTTING ROUTINE

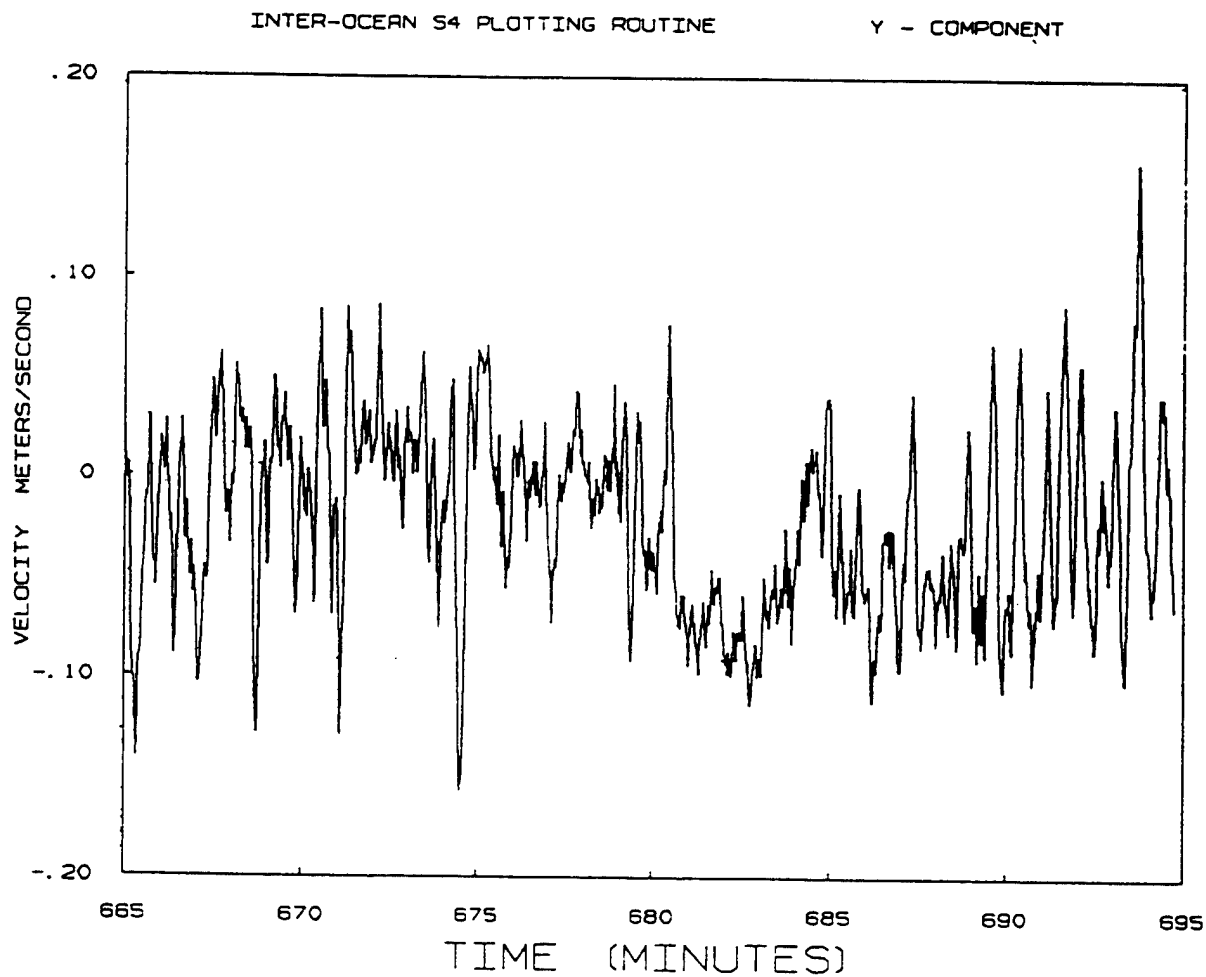
Y - COMPONENT



meter number	071	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	MEAN =	0.39
speed	4.2 mph	VMAX =	0.63 TMAX = 680.
direction	upstream	VMIN =	0.20 TMIN = 692.



meter number	071	distance	310
tow name	hugh c.	start-time	1105
configuration	3x5	end-time	1135
draft	8.5	MEAN	= -0.01
speed	4.2 mph	VMAX	= 0.16 TMAX = 694.
direction	upstream	VMIN	= -0.16 TMIN = 674.



XX-4. Velocity fluctuations measured by two-dimensional current meters
for barge *Jeff Boat* at Kampsville, trip 1

Jeff Boat (10/14/90)

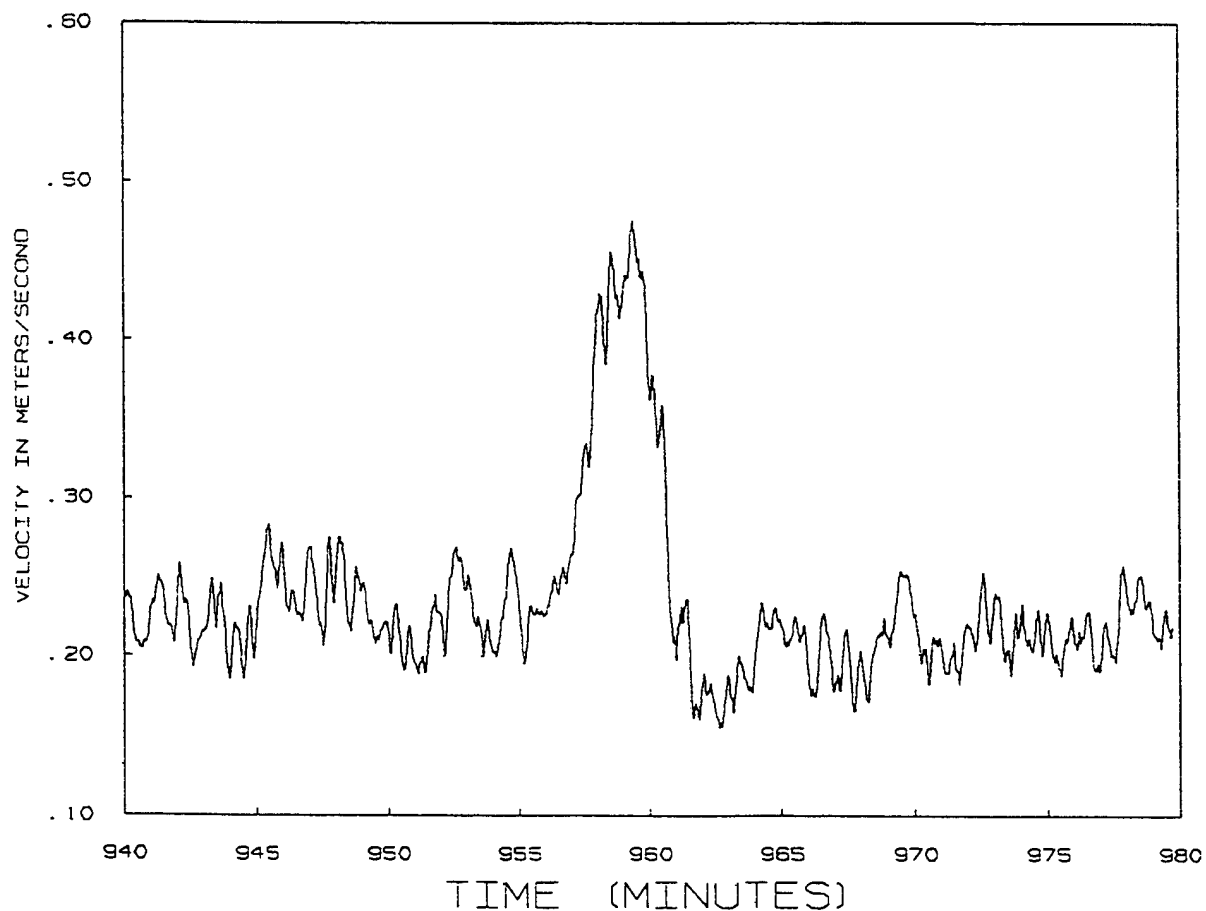
Status of Electromagnetic Current Meters:

1001 (MMB511) ✓	998 (MMB511) ✓	999 (MMB511) ✓	1000 (MMB511) ✓
332 (MMB527) ✓	642 (MMB527) ✓		
040 (S4) ✓	071 (S4) ✓		

Note: ✓ : Working
* : Not working

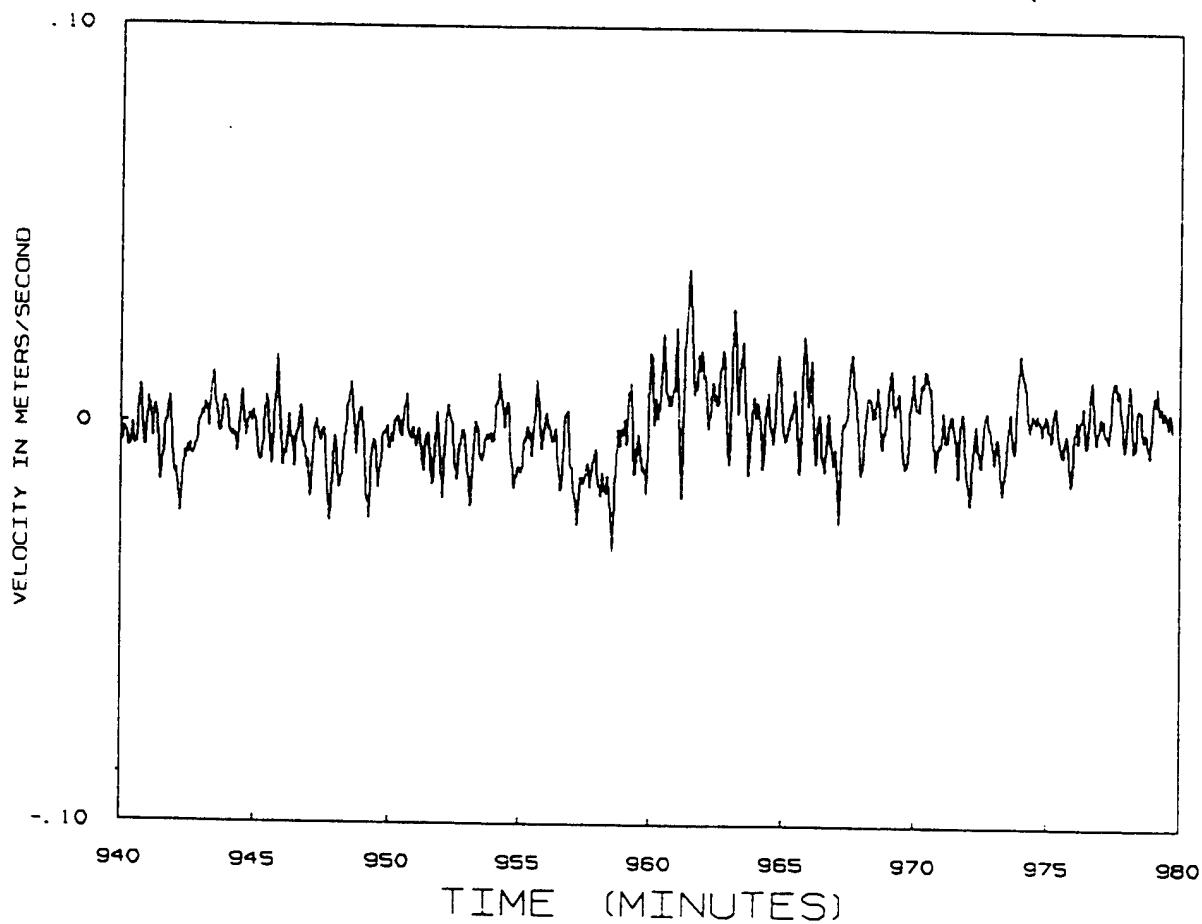
meter number	511-1001	start-time	1540
tow name	jeff boat	end-time	1620
configuration	3x5	mean =	0.23
draft	9.0	vmax =	0.00 tmax = 959.
speed	4.2 mph	vmin =	0.00 tmin = 963.
direction	upstream		
distance	375		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT

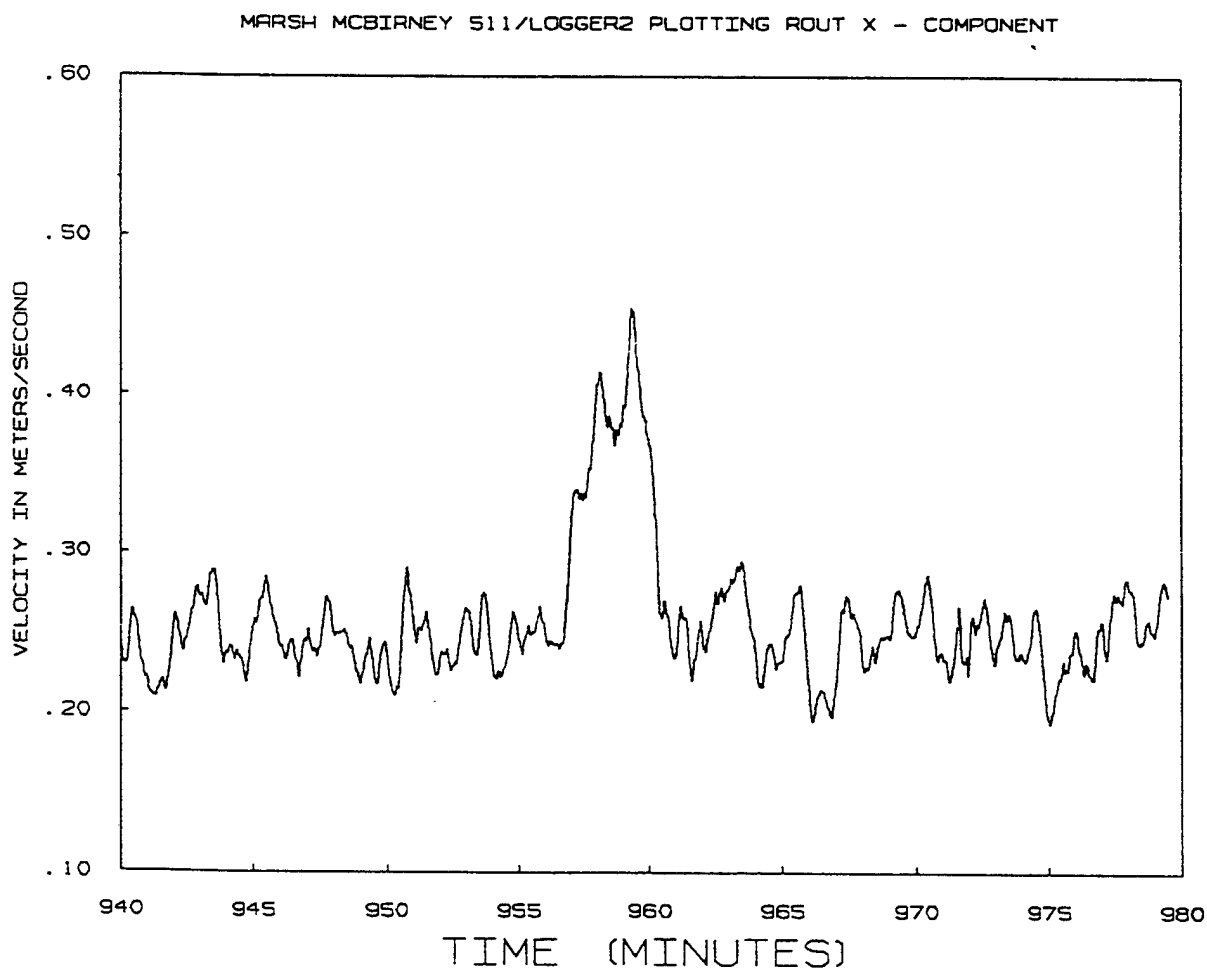


meter number	511-1001	start-time	1540
tow name	jeff boat	end-time	1620
configuration	3x5	mean =	0.00
draft	9.0	vmax =	0.00 tmax = 961.
speed	4.2 mph	vmin =	0.00 tmin = 959.
direction	upstream		
distance	375		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT

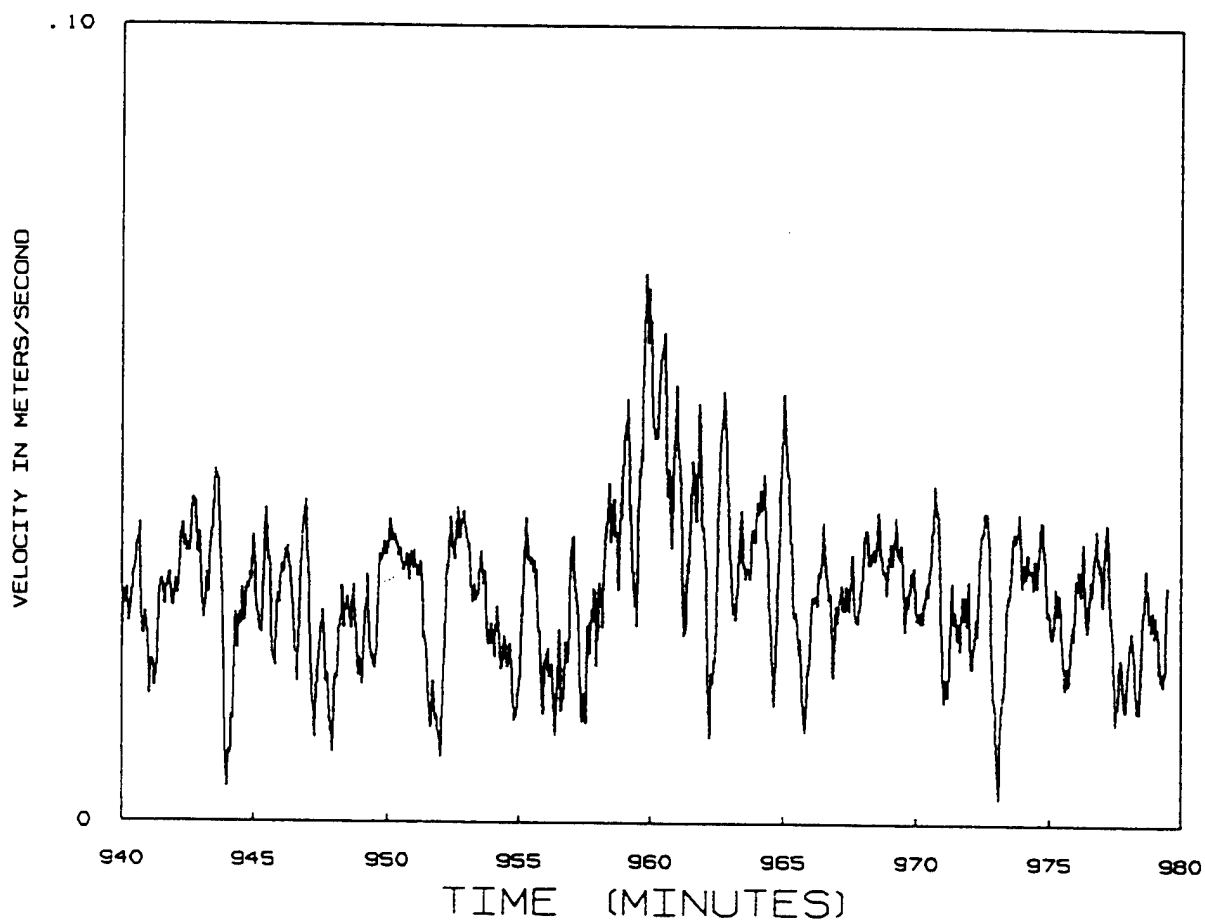


meter number	998	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1620
draft	9.0	mean =	0.24
speed	4.2 mph	vmax =	0.45 tmax = 959.
direction	upstream	vmin =	0.19 tmin = 975.

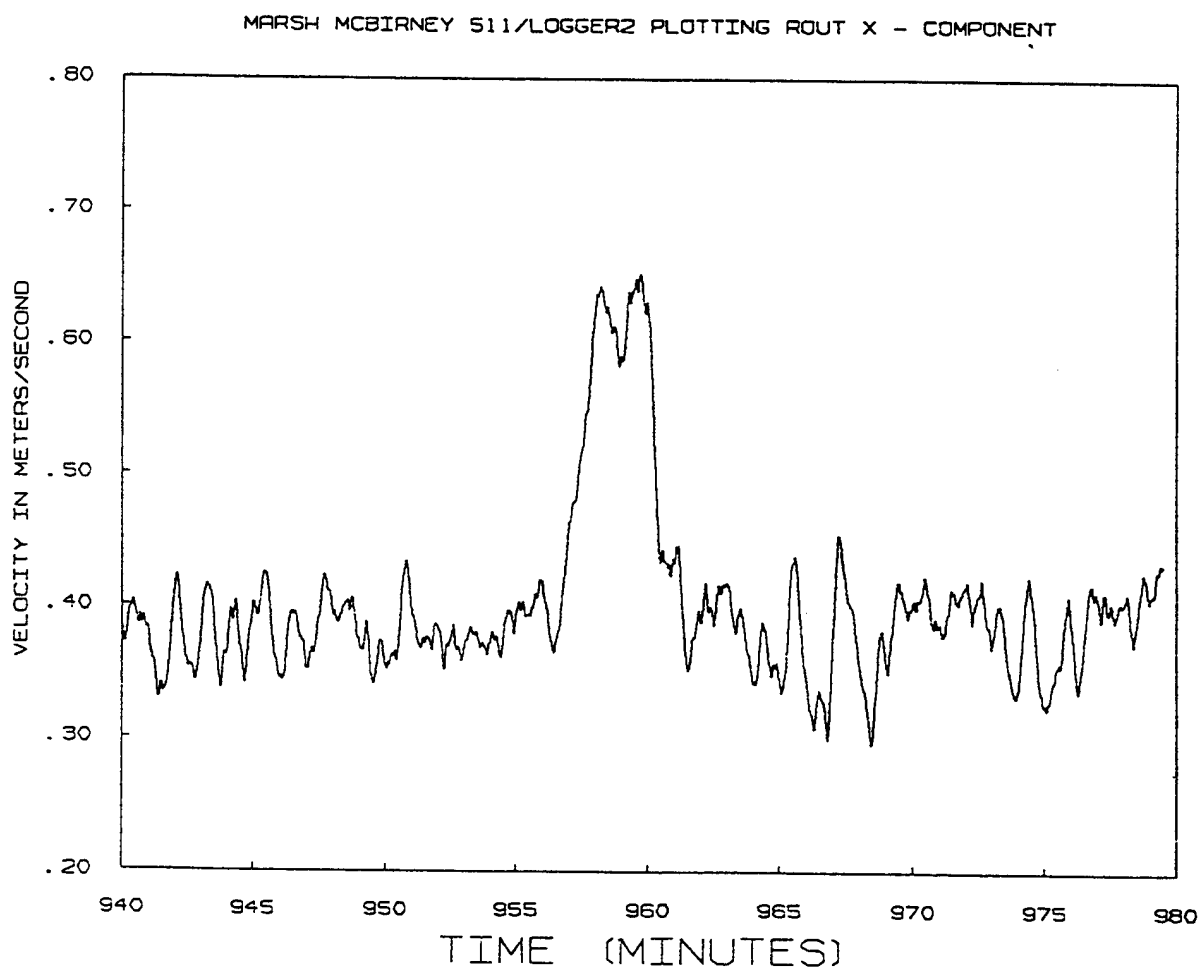


meter number	998	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1620
draft	9.0	mean =	0.03
speed	4.2 mph	vmax =	0.07 tmax = 960.
direction	upstream	vmin =	0.00 tmin = 973.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT

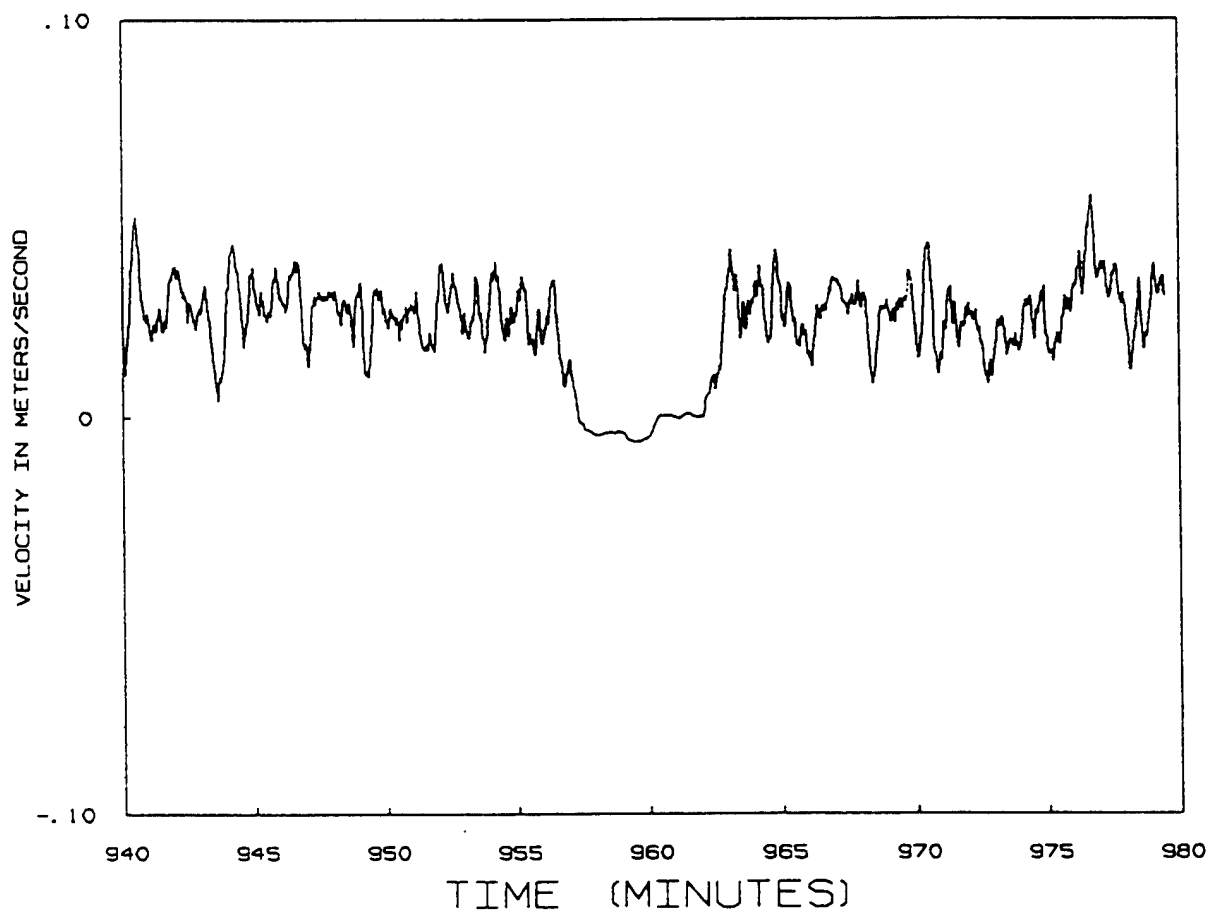


meter number	999	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1620
draft	9.0	mean =	0.38
speed	4.2 mph	vmax =	0.65 tmax = 960.
direction	upstream	vmin =	0.30 tmin = 968.



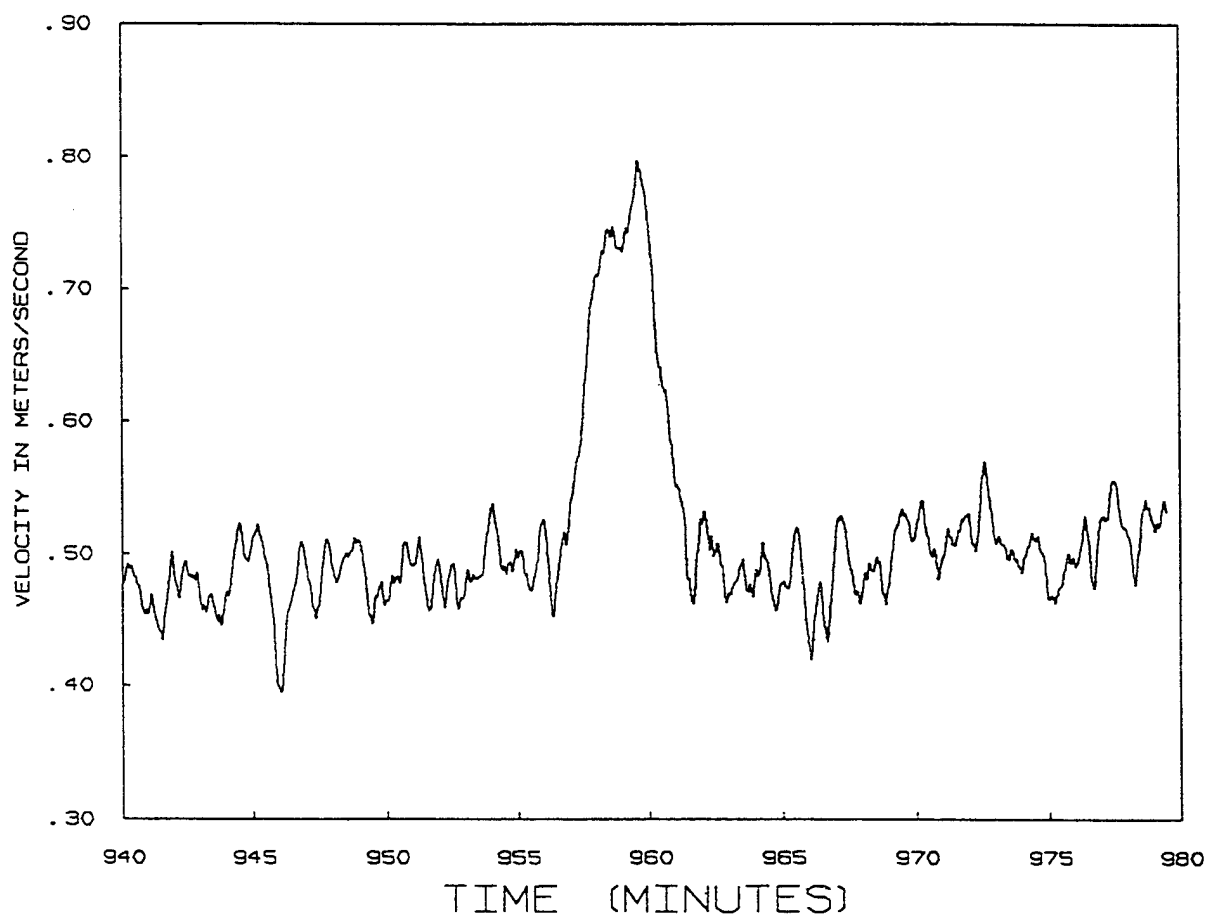
meter number	999	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1620
draft	9.0	mean =	0.03
speed	4.2 mph	vmax =	0.06 tmax = 977.
direction	upstream	vmin =	-0.01 tmin = 960.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT Y - COMPONENT



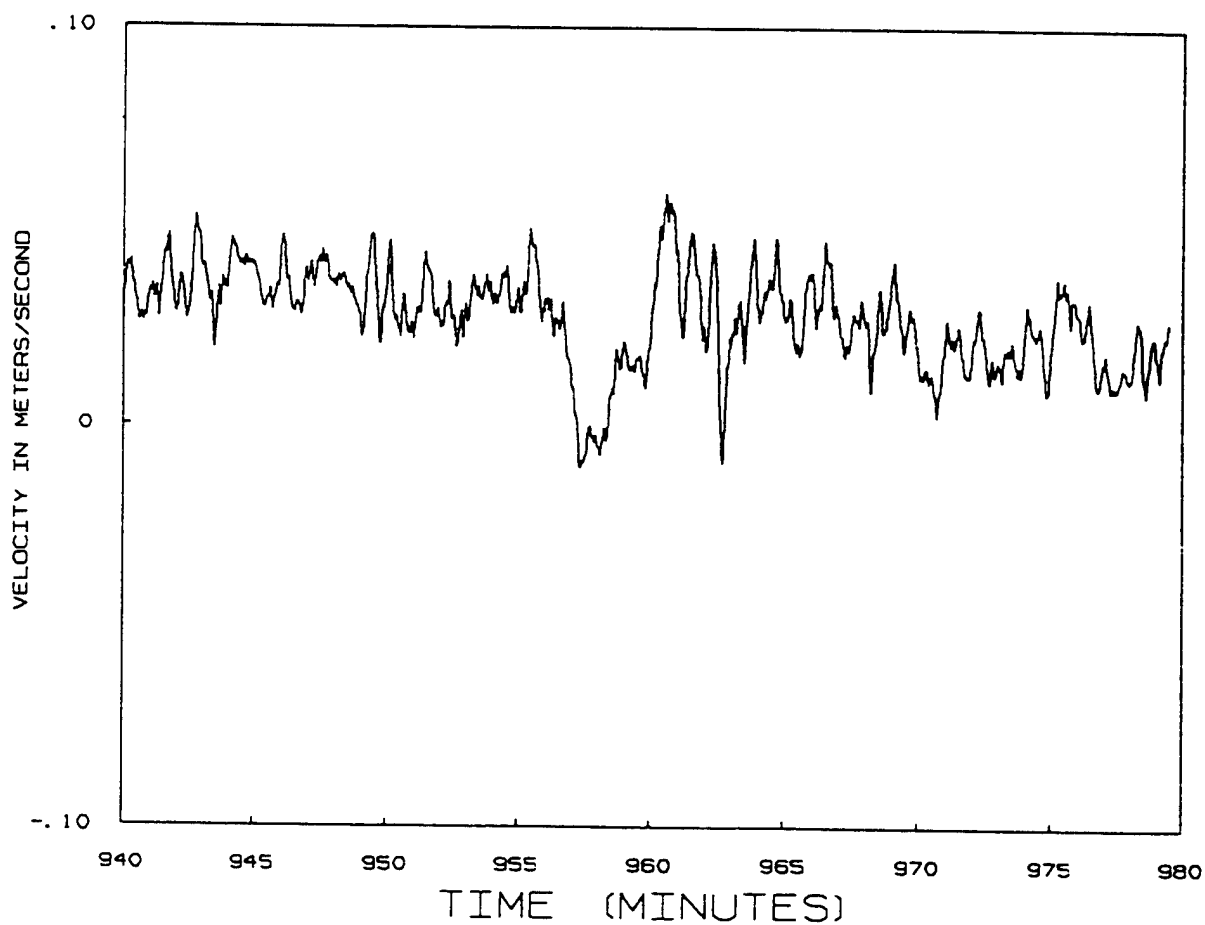
meter number	1000	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1620
draft	9.0	mean =	0.48
speed	4.2 mph	vmax =	0.80 tmax = 960.
direction	upstream	vmin =	0.39 tmin = 946.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT

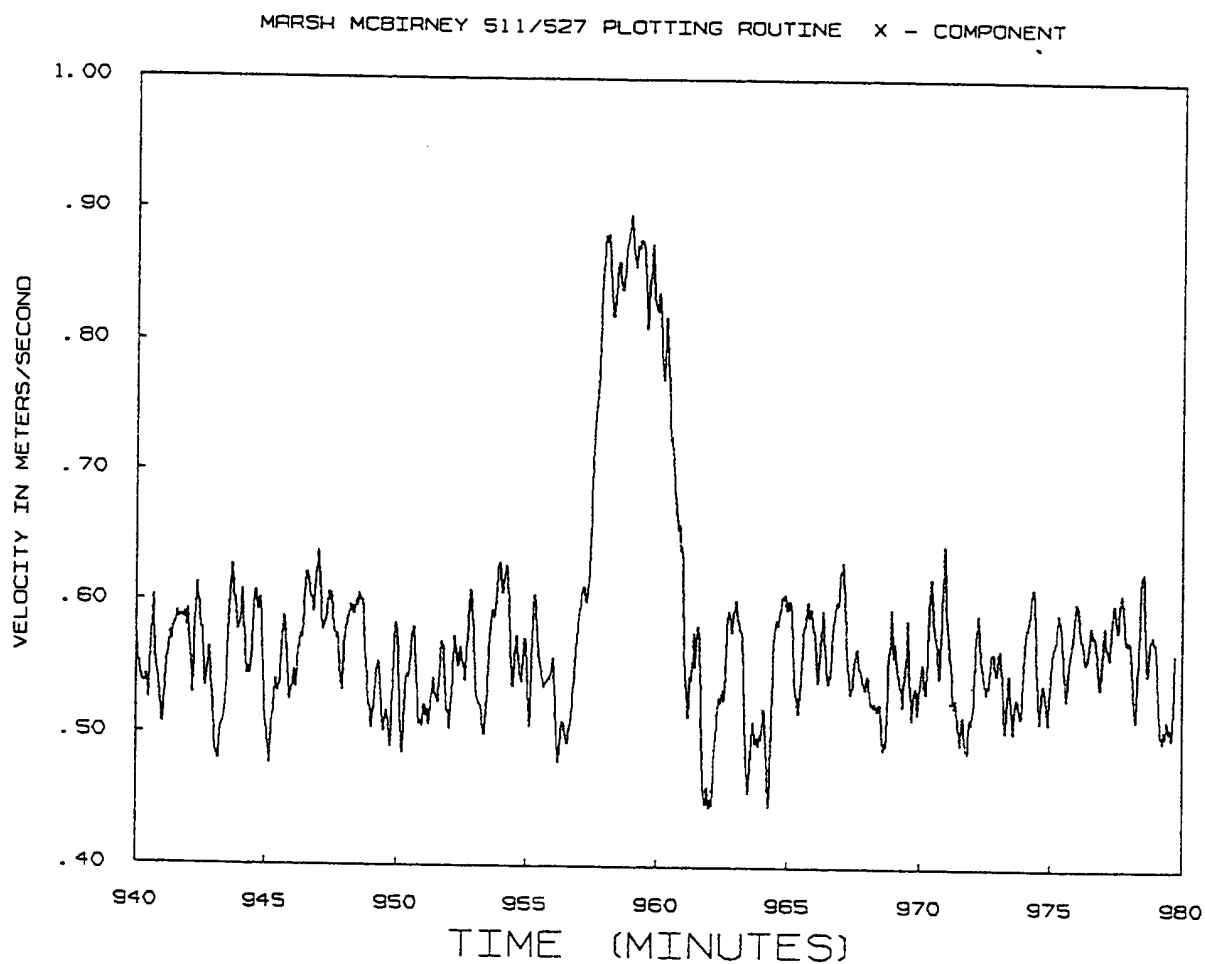


meter number	1000	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1620
draft	9.0	mean =	0.04
speed	4.2 mph	vmax =	0.06 tmax = 961.
direction	upstream	vmin =	-0.01 tmin = 957.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT

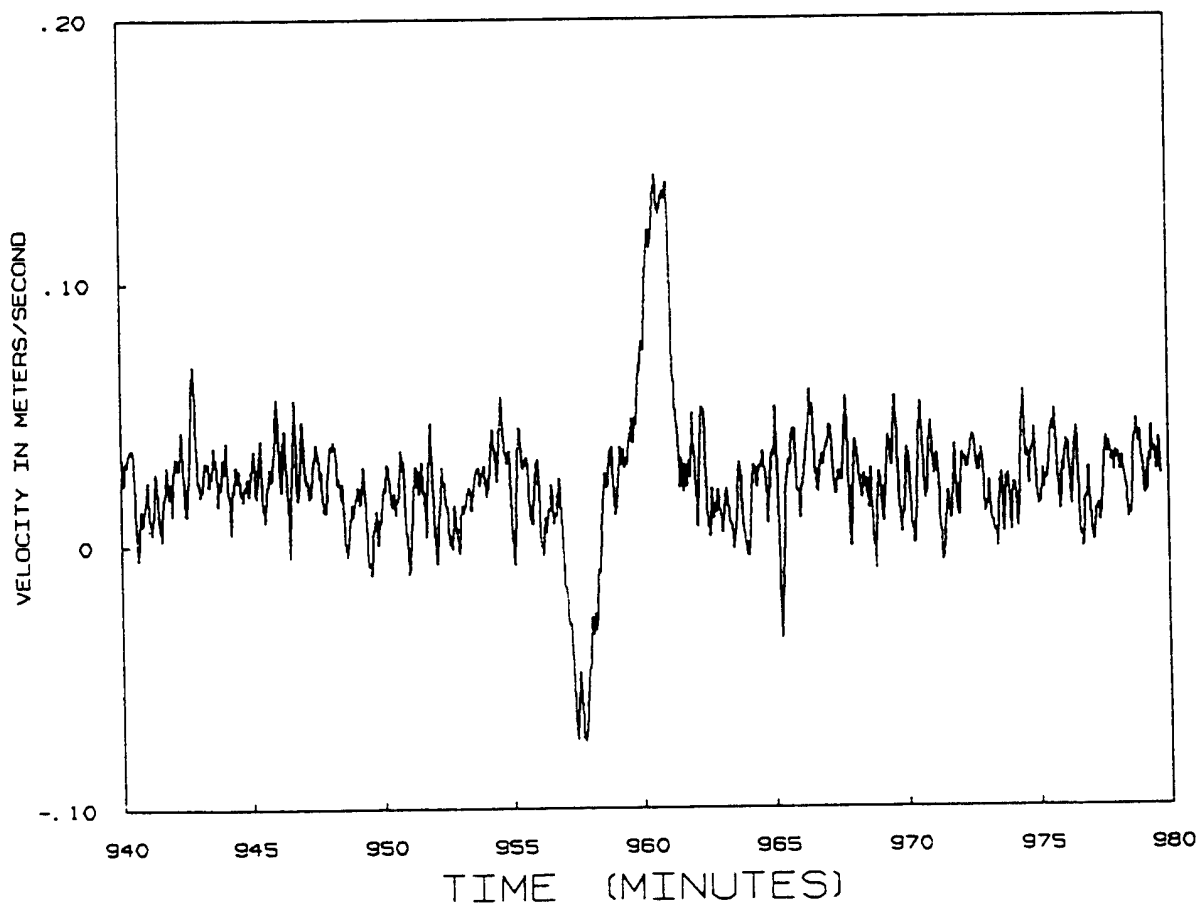


meter number	B-332	start-time	1540
tow name	jeff boat	end-time	1620
configuration	3x5	mean =	0.56
draft	9.0	vmax =	0.00 tmax = 959.
speed	4.2 mph	vmin =	0.00 tmin = 962.
direction	upstream		
distance	375		



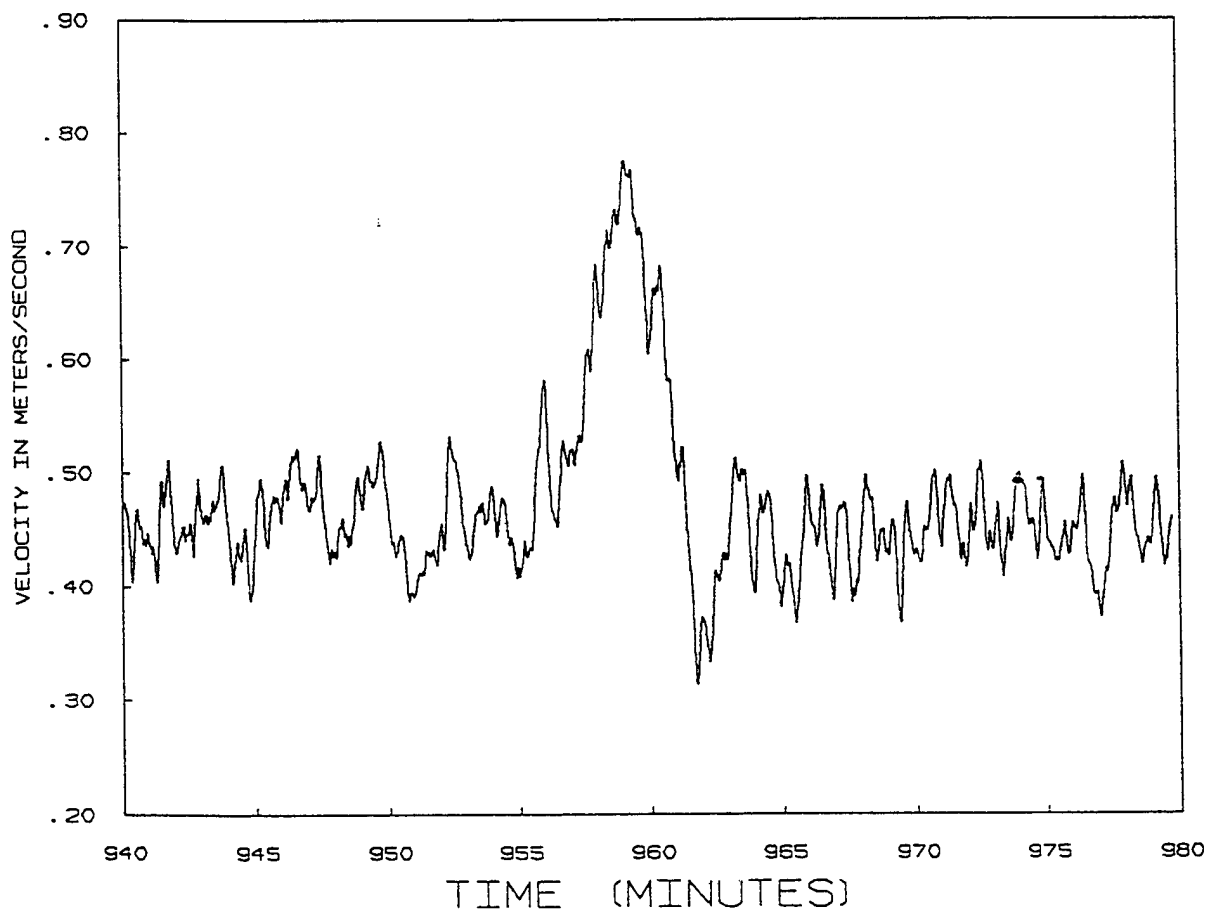
meter number	B-332	start-time	1540
tow name	jeff boat	end-time	1620
configuration	3x5	mean =	0.02
draft	9.0	vmax =	0.00 tmax = 961.
speed	4.2 mph	vmin =	0.00 tmin = 958.
direction	upstream		
distance	375		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



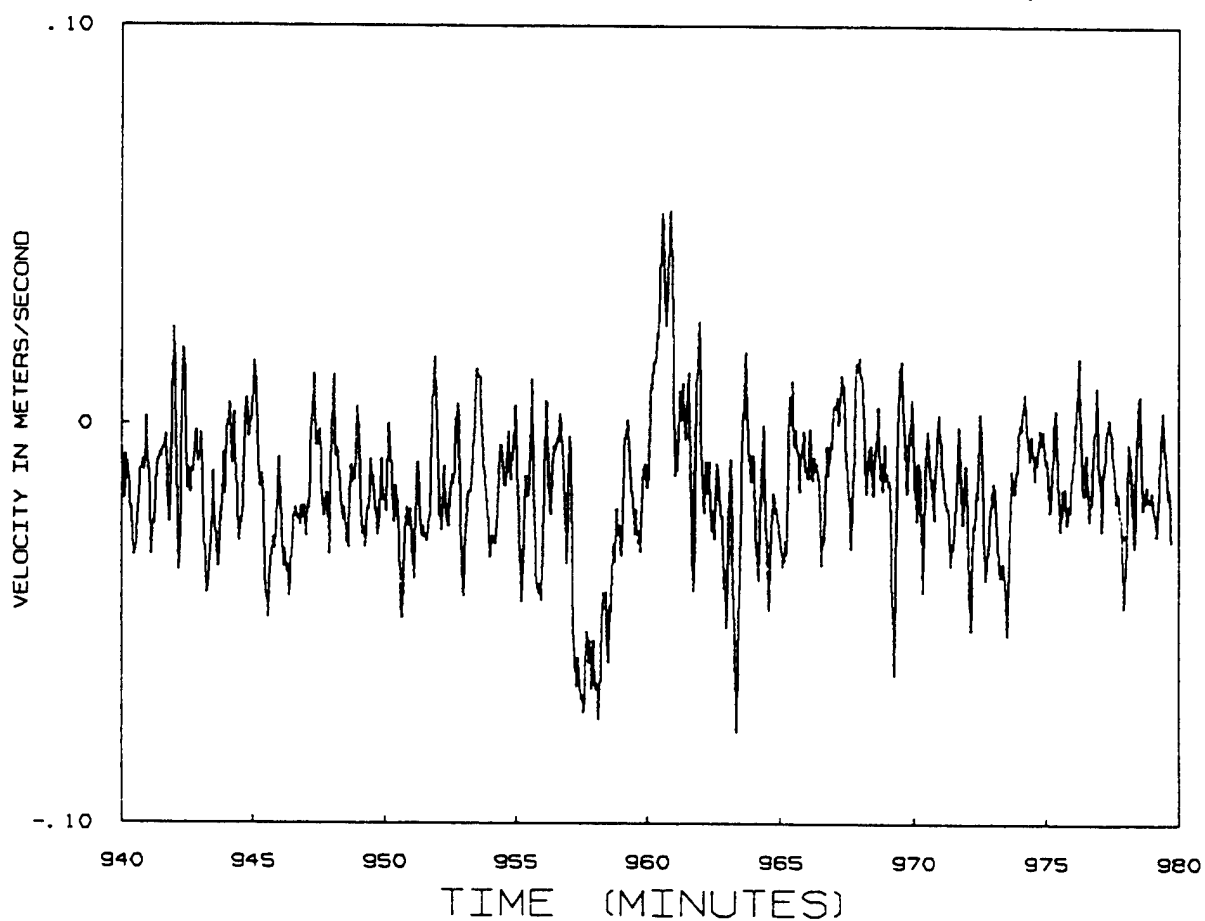
meter number	B-642	start-time	1540
tow name	jeff boat	end-time	1620
configuration	3x5	mean =	0.46
draft	9.0	vmax =	0.00 tmax = 959.
speed	4.2 mph	vmin =	0.00 tmin = 962.
direction	upstream		
distance	375		

MARSH MCBIRNEY S11/S27 PLOTTING ROUTINE X - COMPONENT

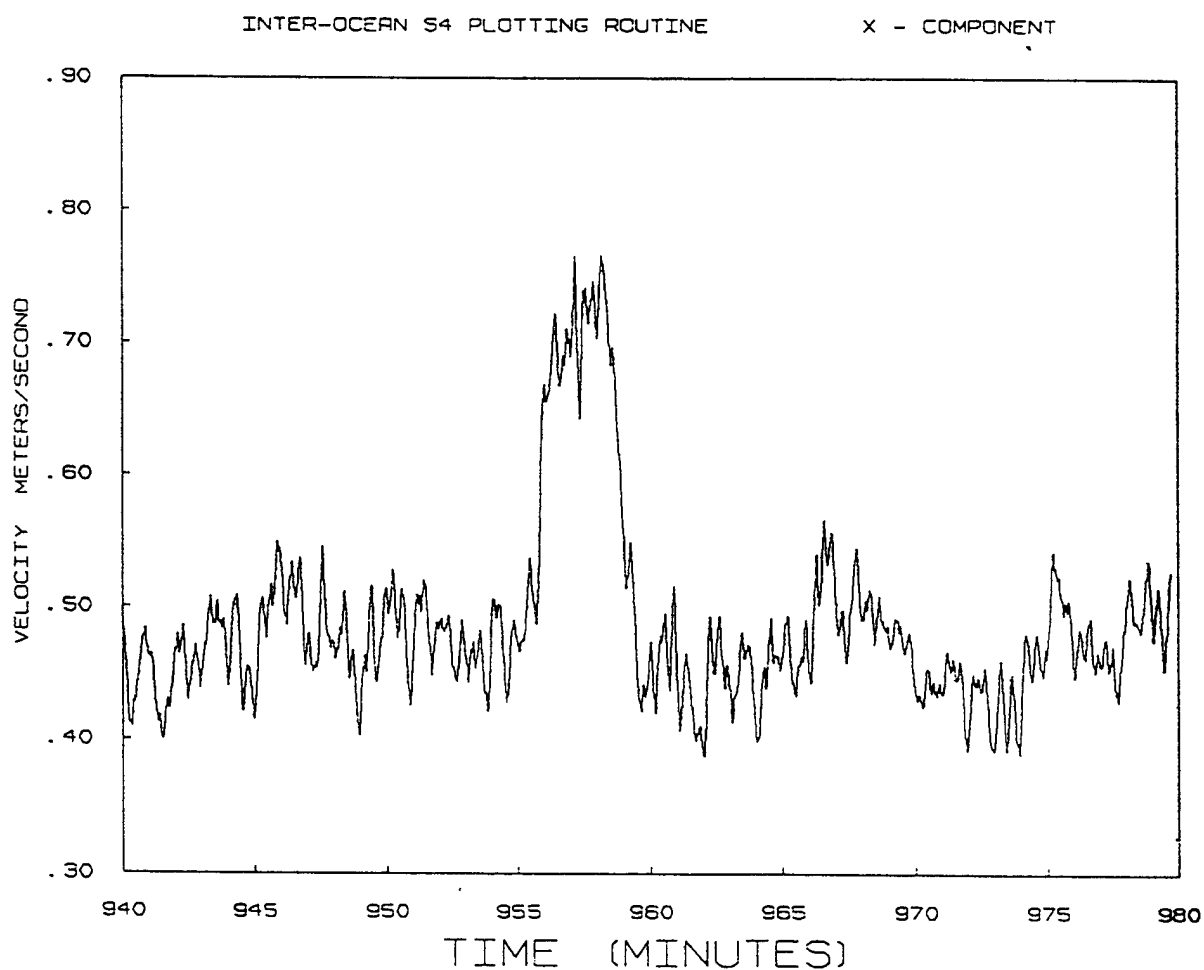


meter number	B-642	start-time	1540
tow name	jeff boat	end-time	1620
configuration	3x5	mean	= -0.02
draft	9.0	vmax	= 0.00 tmax = 961.
speed	4.2 mph	vmin	= 0.00 tmin = 963.
direction	upstream		
distance	375		

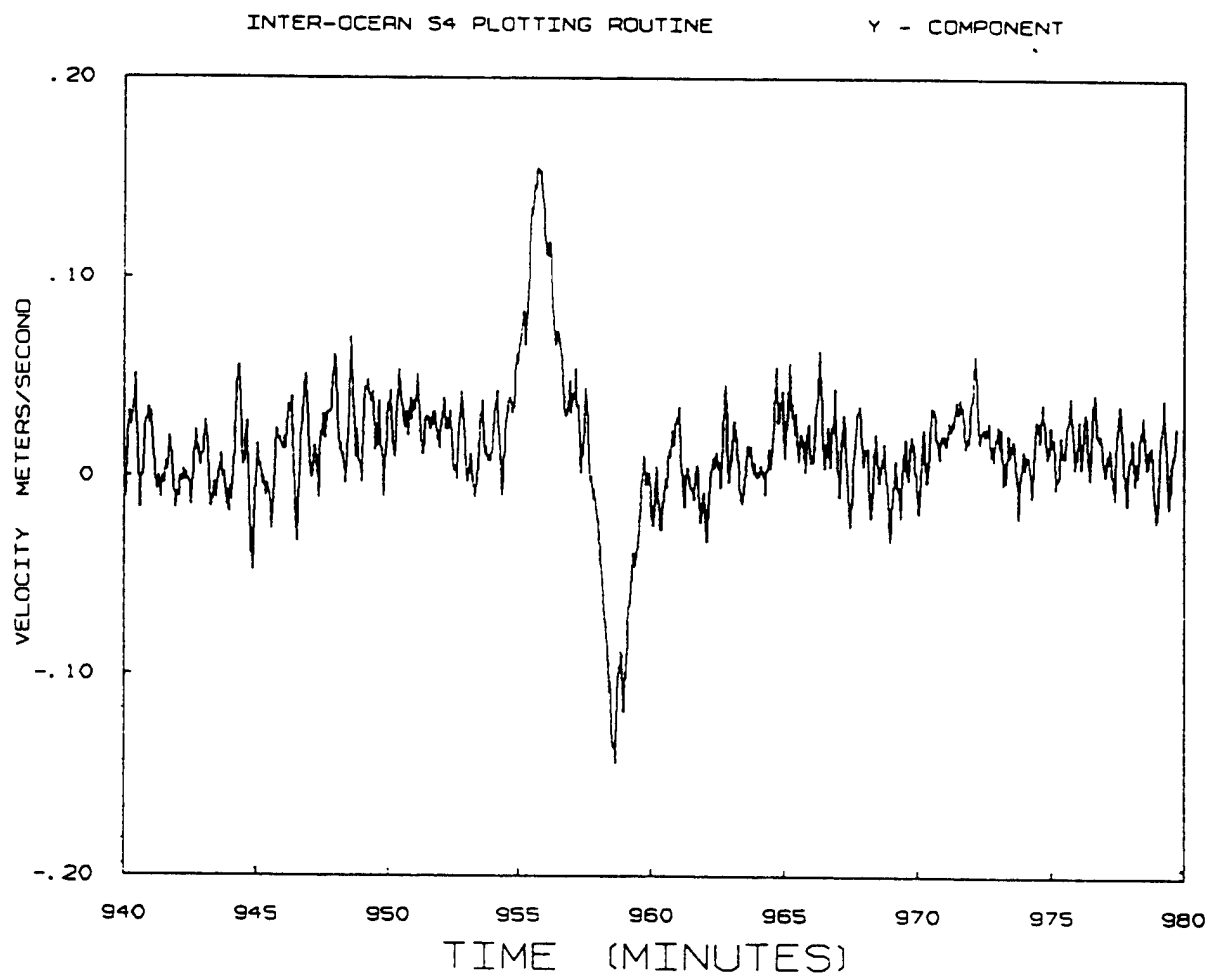
MARSH MCBIRNEY S11/S27 PLOTTING ROUTINE Y - COMPONENT



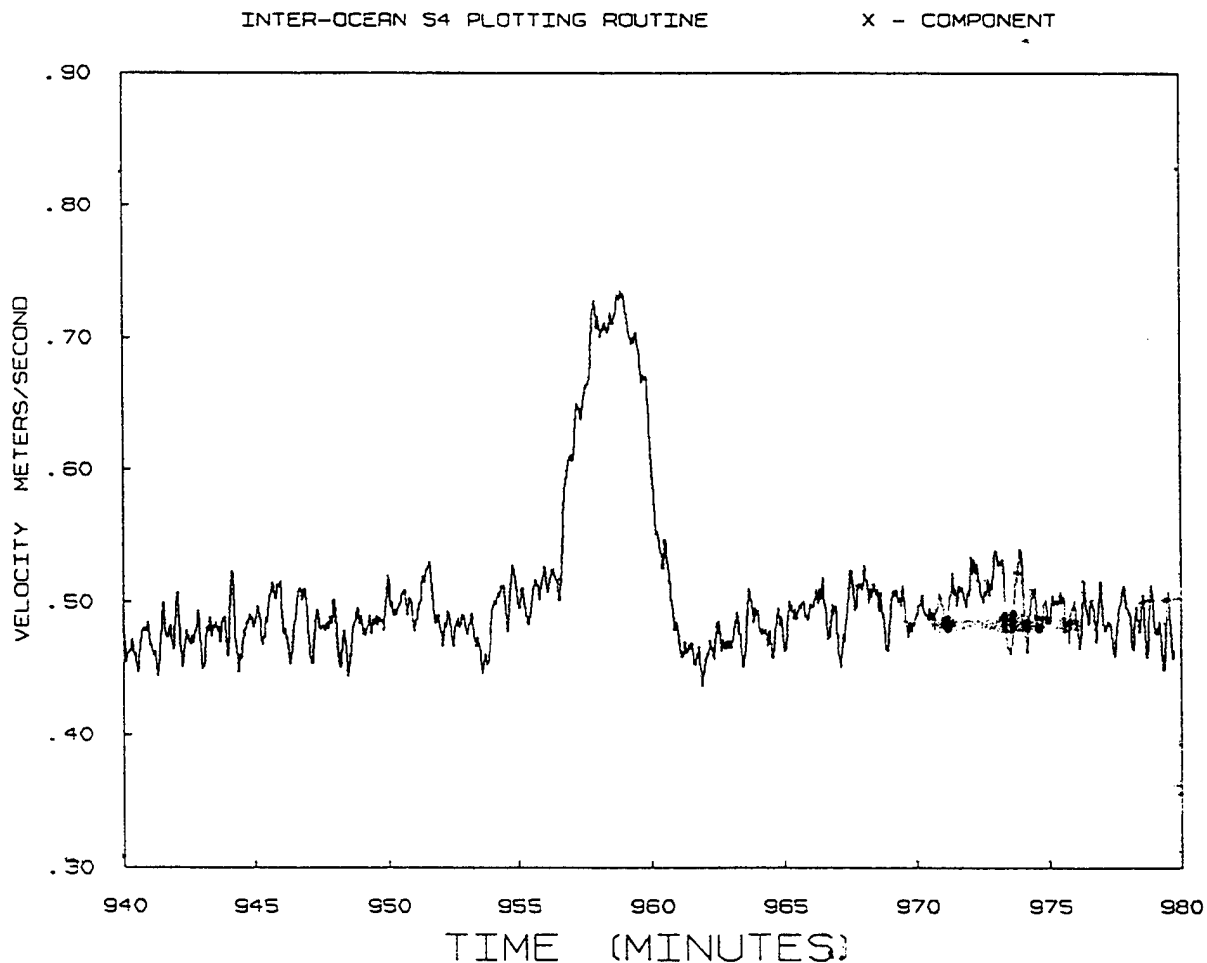
meter number	040	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1620
draft	9.0	MEAN =	0.47
speed	4.2 mph	VMAX =	0.77 TMAX = 958.
direction	upstream	VMIN =	0.39 TMIN = 962.



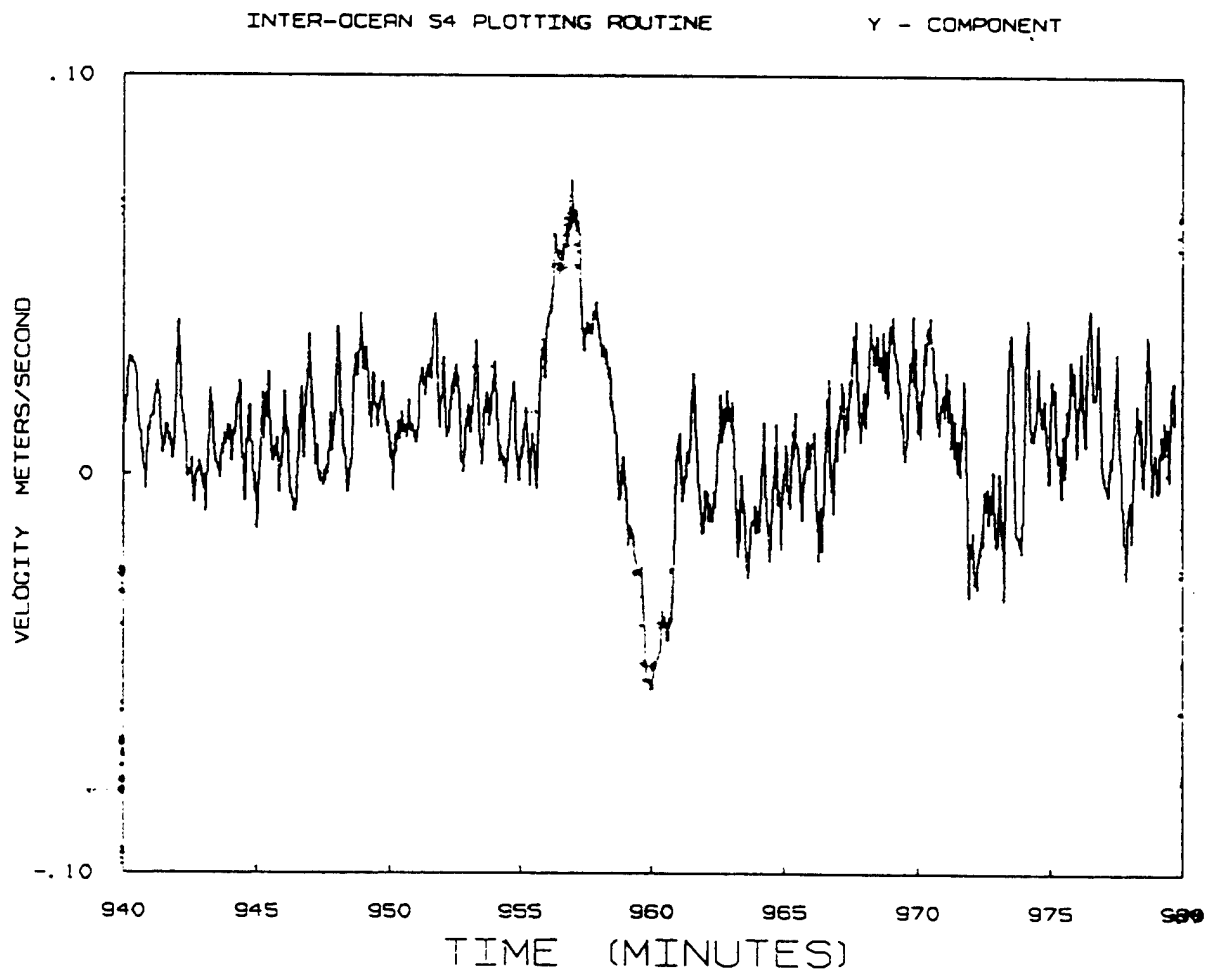
meter number	040	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1620
draft	9.0	MEAN =	0.01
speed	4.2 mph	VMAX =	0.16 TMAX = 956.
direction	upstream	VMIN =	-0.14 TMIN = 959.



meter number	071	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1620
draft	9.0	MEAN =	0.48
speed	4.2 mph	VMAX =	0.74 TMAX = 959.
direction	upstream	VMIN =	0.44 TMIN = 962.



meter number	071	distance	375
tow name	jeff boat	start-time	1540
configuration	3x5	end-time	1820
draft	9.0	MEAN =	0.01
speed	4.2 mph	VMAX =	0.07 TMAX = 957.
direction	upstream	VMIN =	-0.05 TMIN = 960.



XX-5. Velocity fluctuations measured by two-dimensional current meters
for barge *American Beauty* at Clarks Ferry, trip 1

American Beauty (1) (5/20/91)

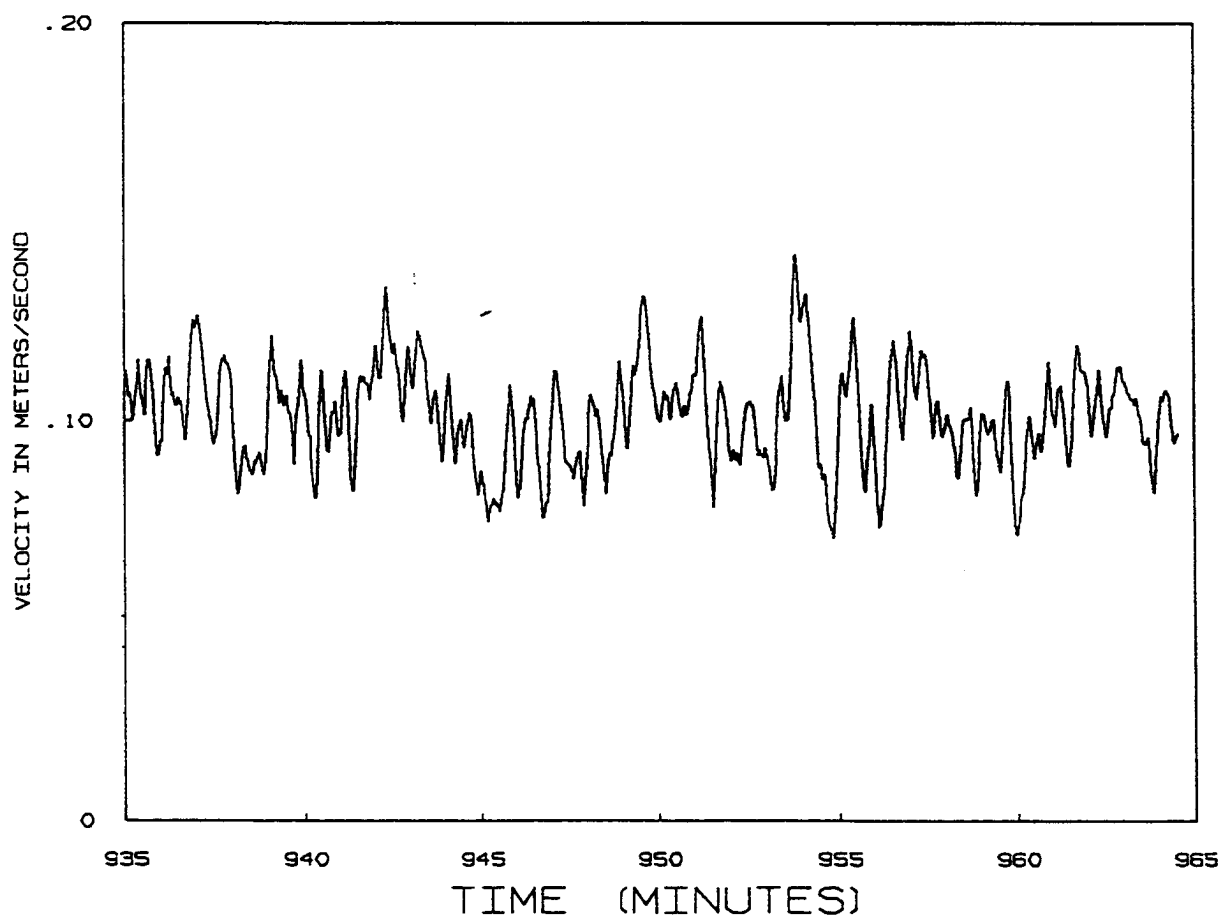
Status of Electromagnetic Current Meters:

1001 (MMB511) ✓	1330 (MMB511) ✓	1331 (MMB511) ✓	998 (MMB511) ✓	999 (MMB511) ✓	1000 (MMB511) ✓
151 (S4) *	834 (S4) ✓	040 (S4) ✓	832 (S4) ✓	071 (S4) *	
332 (MMB527) ✓	642 (MMB527) ✓				

Note: ✓ : Working
* : Not working
- : Not available

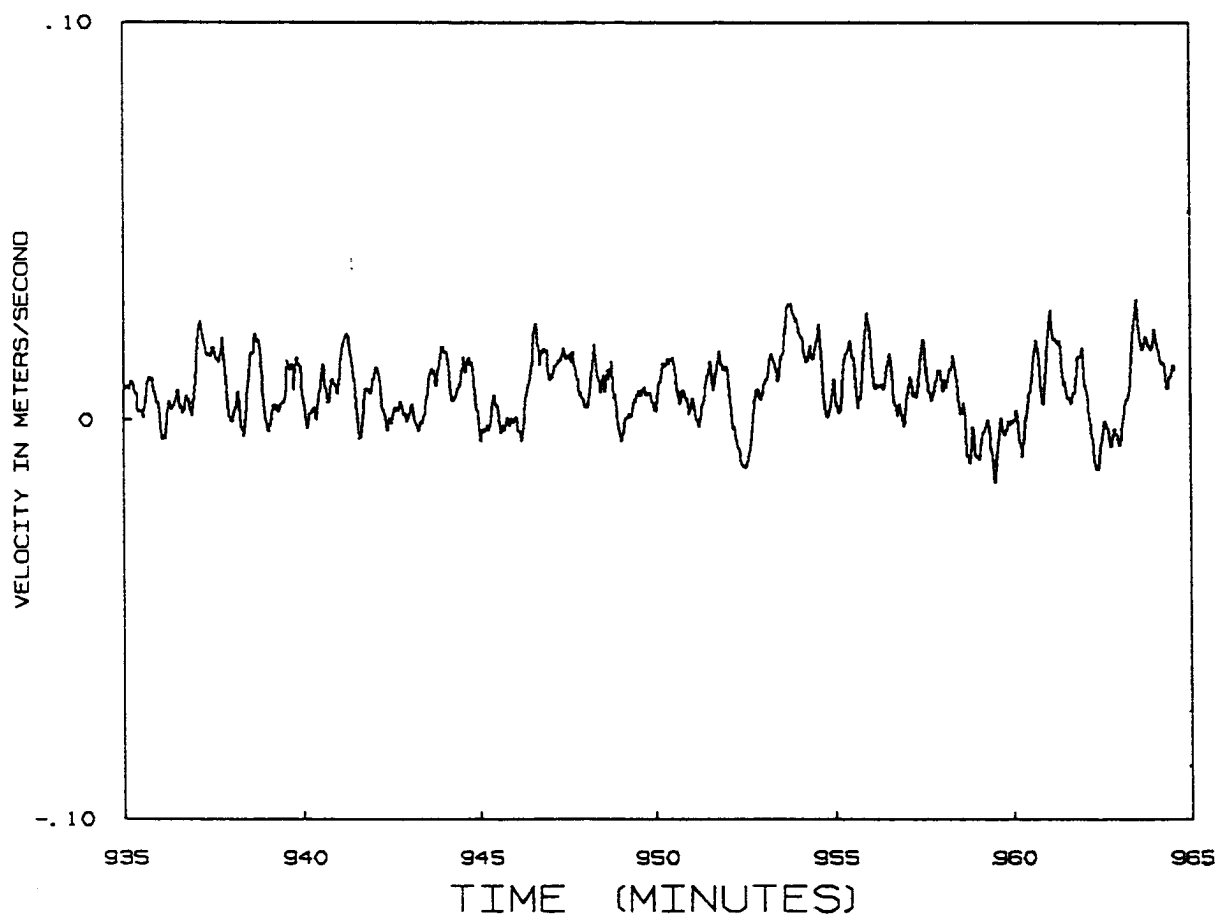
meter number	1001	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.10
speed	7.1 mph	vmax =	0.14 tmax = 954.
direction	upstream	vmin =	0.07 tmin = 955.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



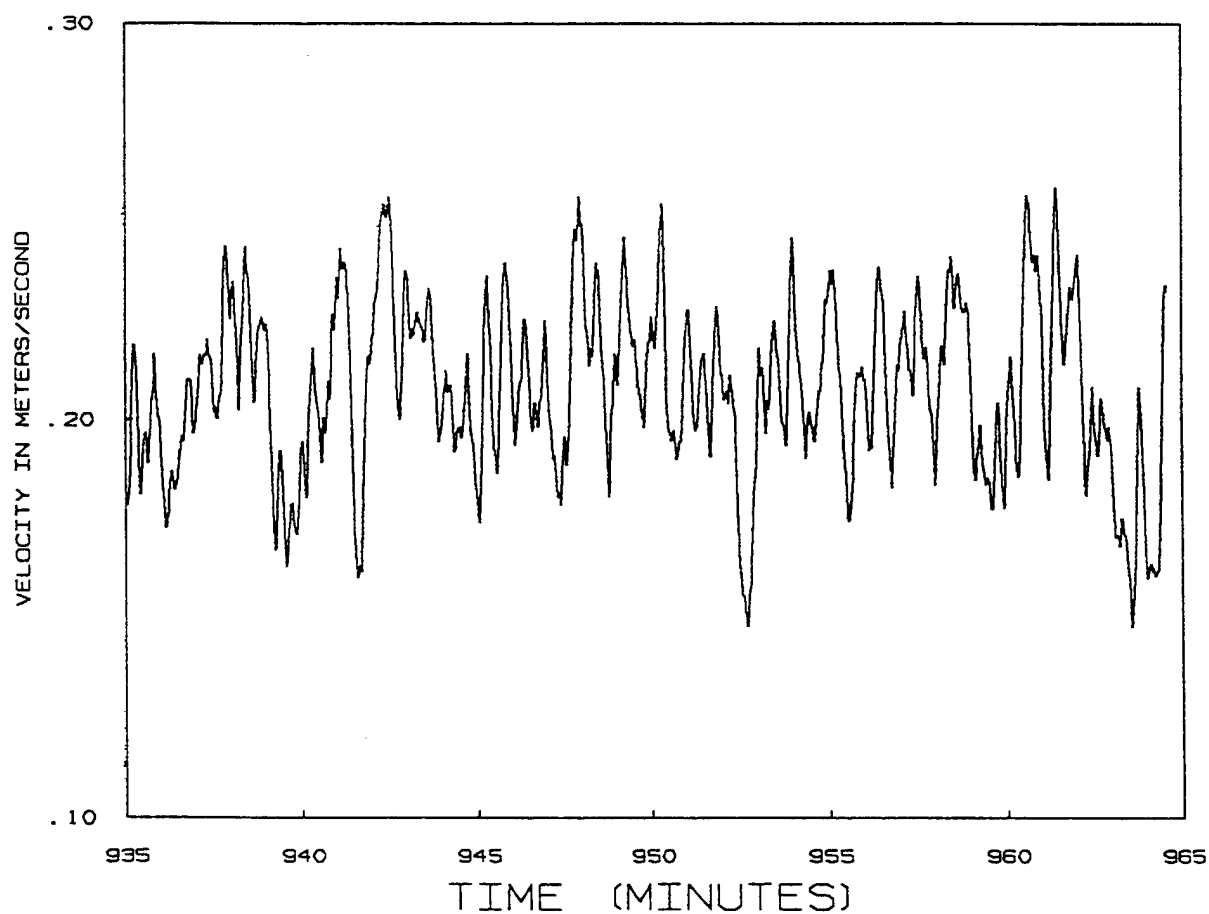
meter number	1001	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.01
speed	7.1 mph	vmax =	0.03 tmax = 963.
direction	upstream	vmin =	-0.02 tmin = 960.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



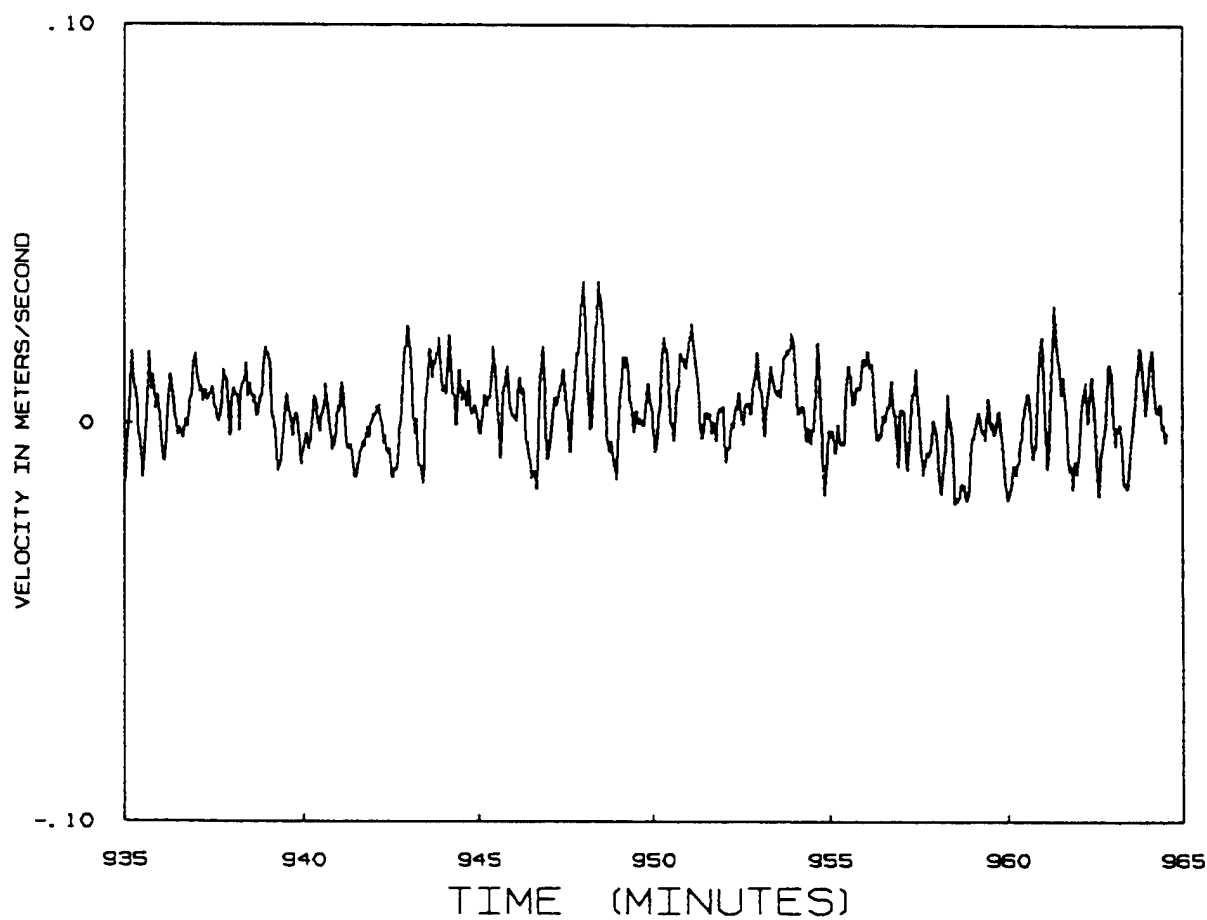
meter number	1130	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.21
speed	7.1 mph	vmax =	0.26 tmax = 961.
direction	upstream	vmin =	0.15 tmin = 964.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



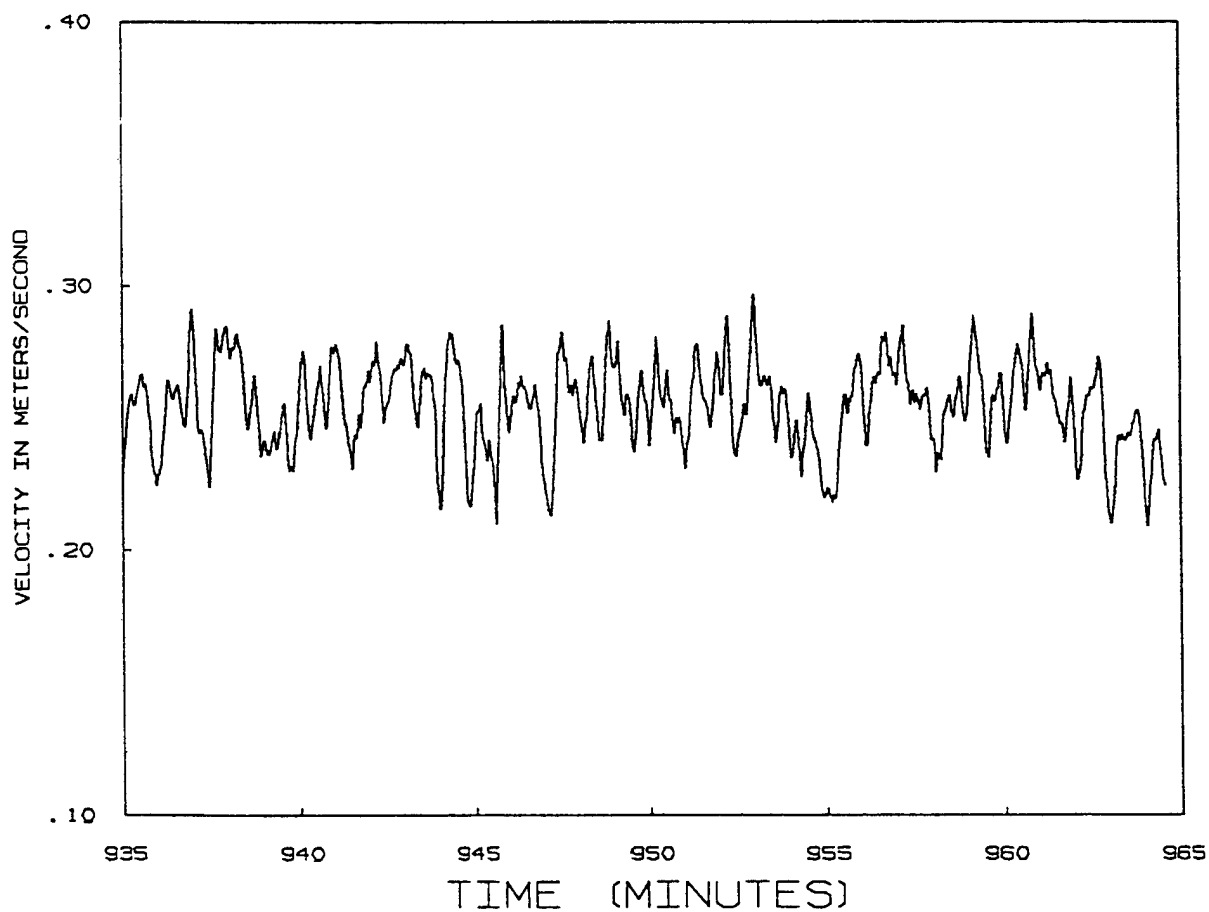
meter number	1130	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.00
speed	7.1 mph	vmax =	0.04 tmax = 948.
direction	upstream	vmin =	-0.02 tmin = 959.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



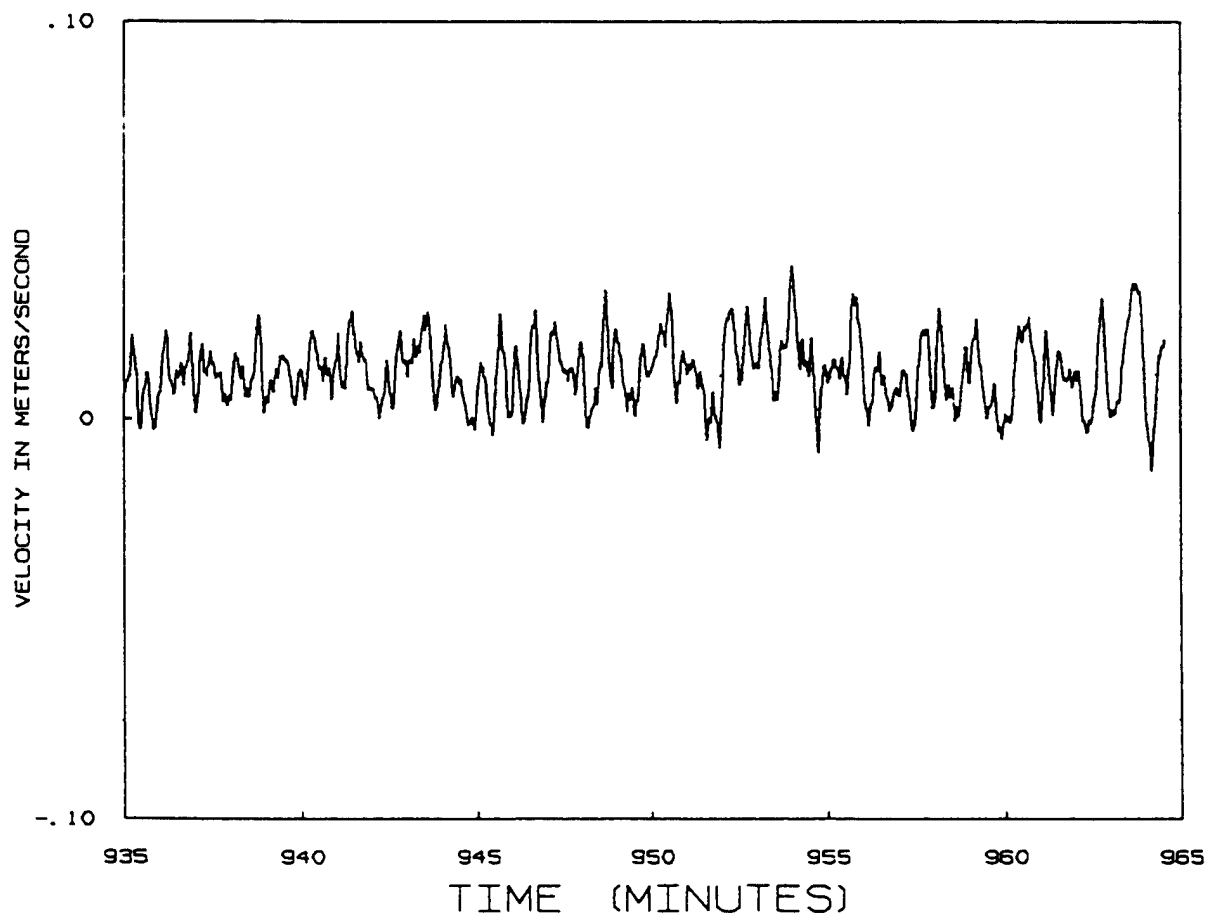
meter number	1131	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.26
speed	7.1 mph	vmax =	0.30 tmax = 953.
direction	upstream	vmin =	0.21 tmin = 964.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



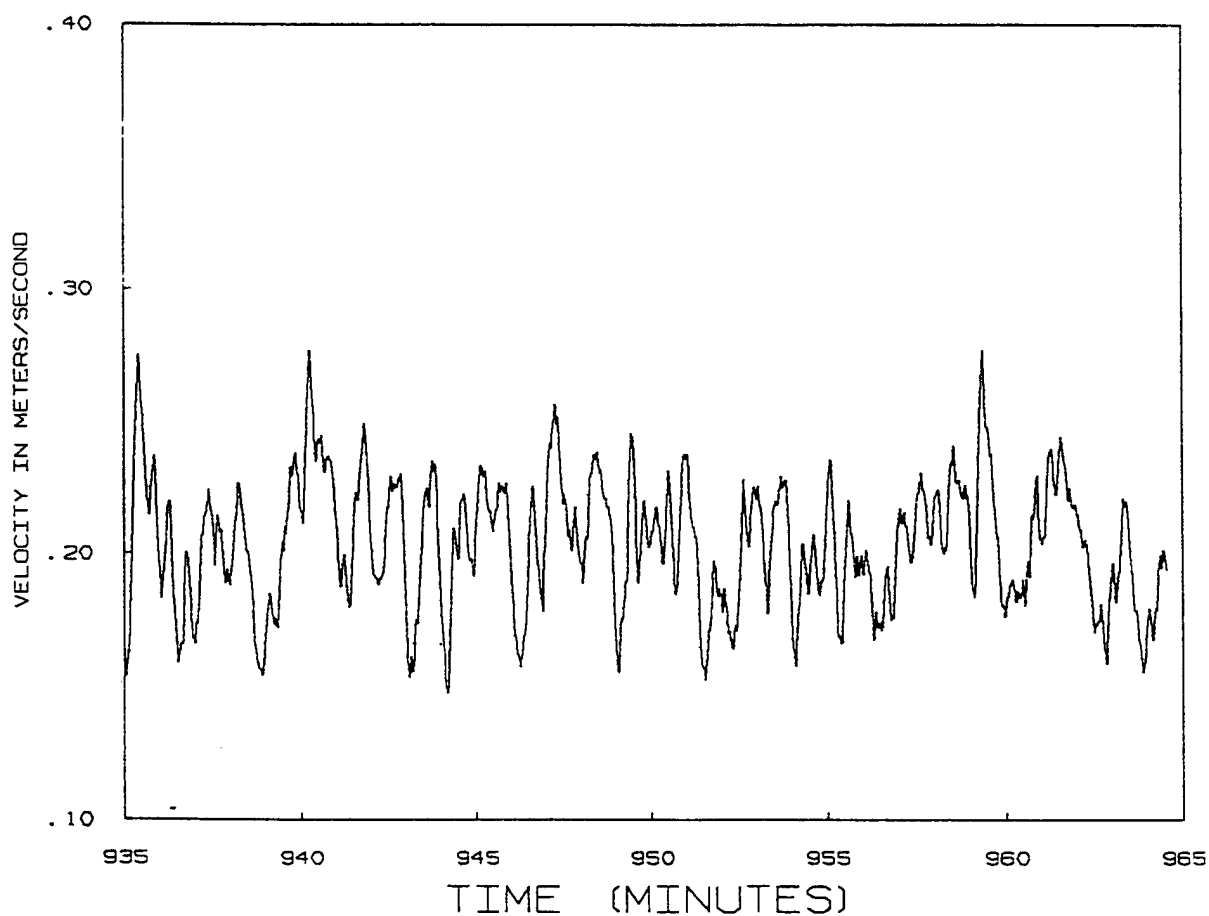
meter number	1131	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.01
speed	7.1 mph	vmax =	0.04 tmax = 954.
direction	upstream	vmin =	-0.01 tmin = 964.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



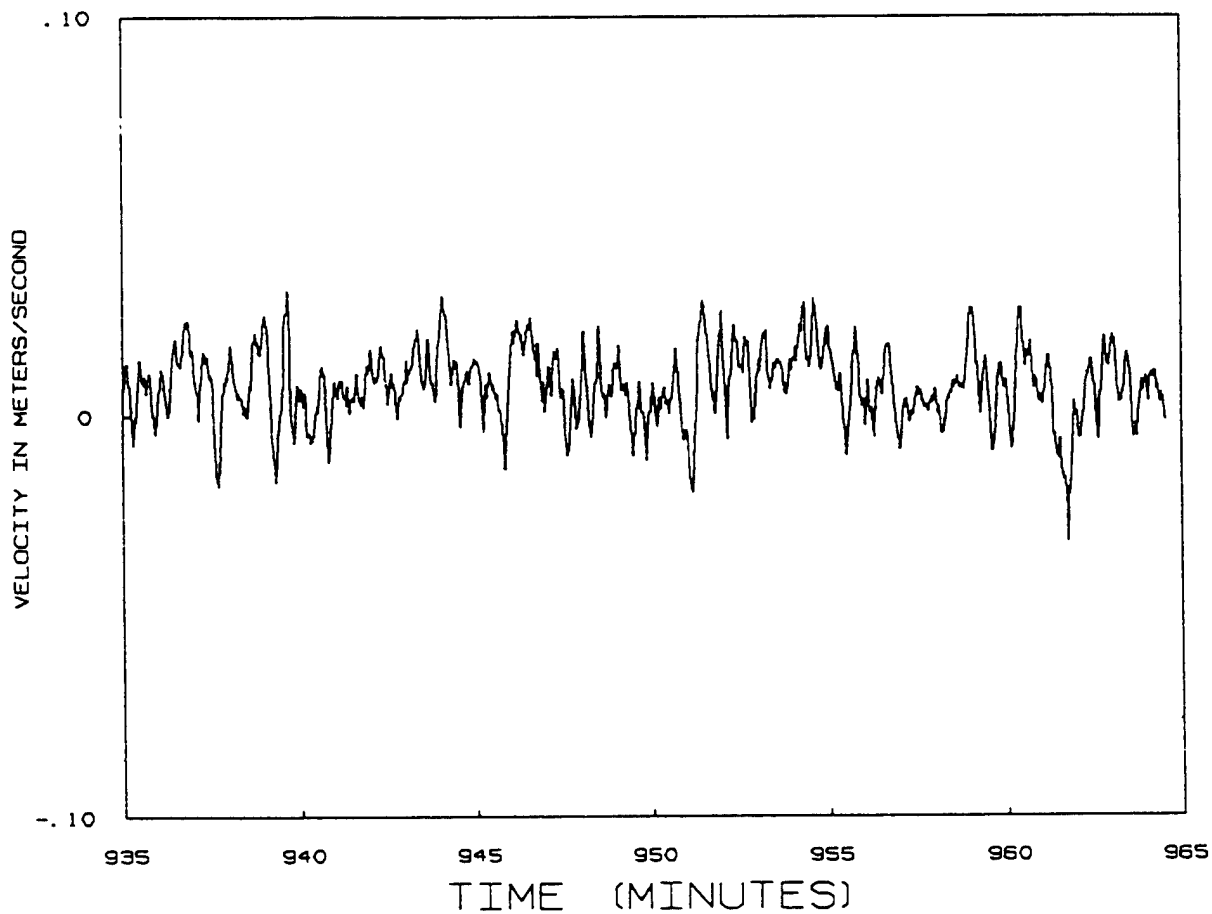
meter number	998	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.20
speed	7.1 mph	vmax =	0.28 tmax = 959.
direction	upstream	vmin =	0.15 tmin = 944.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



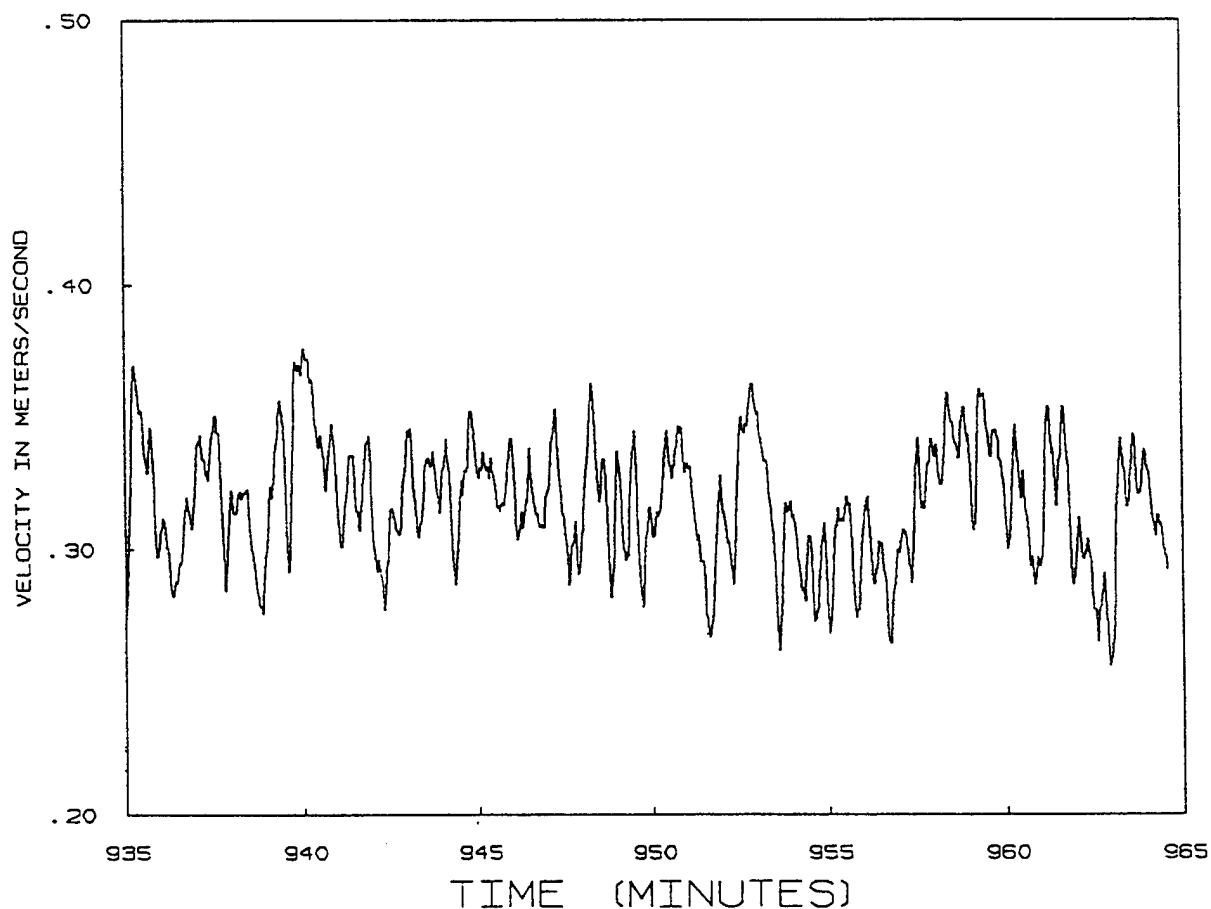
meter number	998	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.01
speed	7.1 mph	vmax =	0.03 tmax = 940.
direction	upstream	vmin =	-0.03 tmin = 962.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT Y - COMPONENT



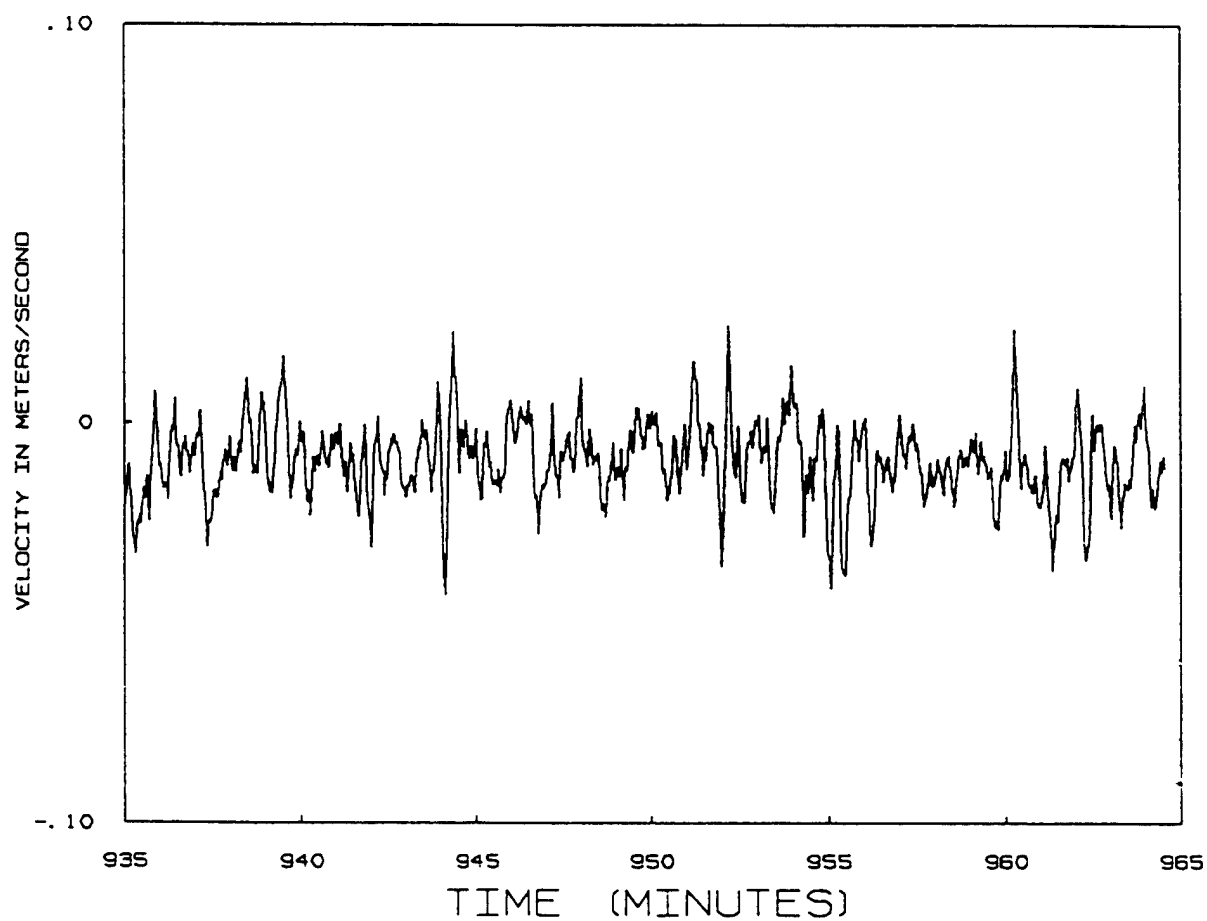
meter number	999	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.32
speed	7.1 mph	vmax =	0.38 tmax = 940.
direction	upstream	vmin =	0.26 tmin = 963.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



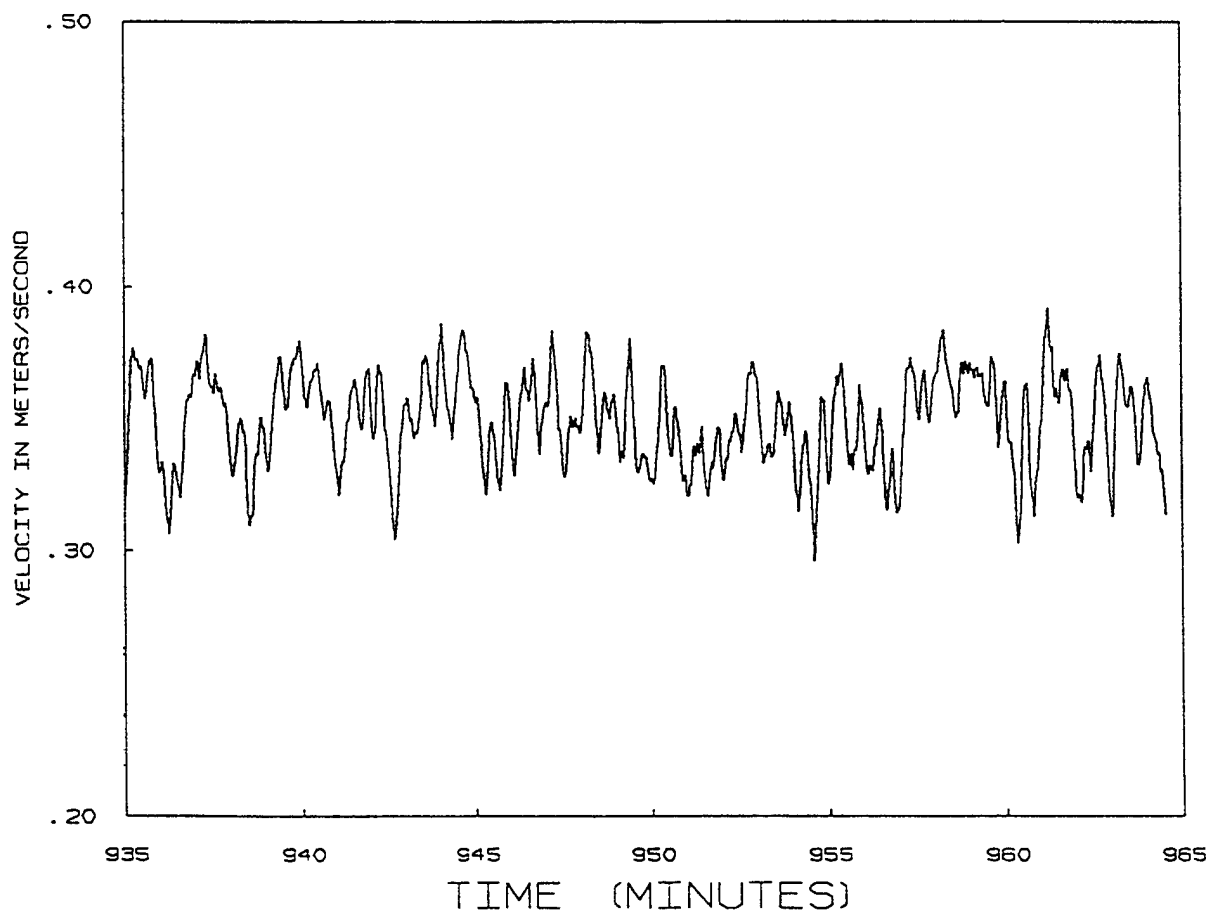
meter number	999	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	-0.01
speed	7.1 mph	vmax =	0.02 tmax = 952.
direction	upstream	vmin =	-0.04 tmin = 944.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



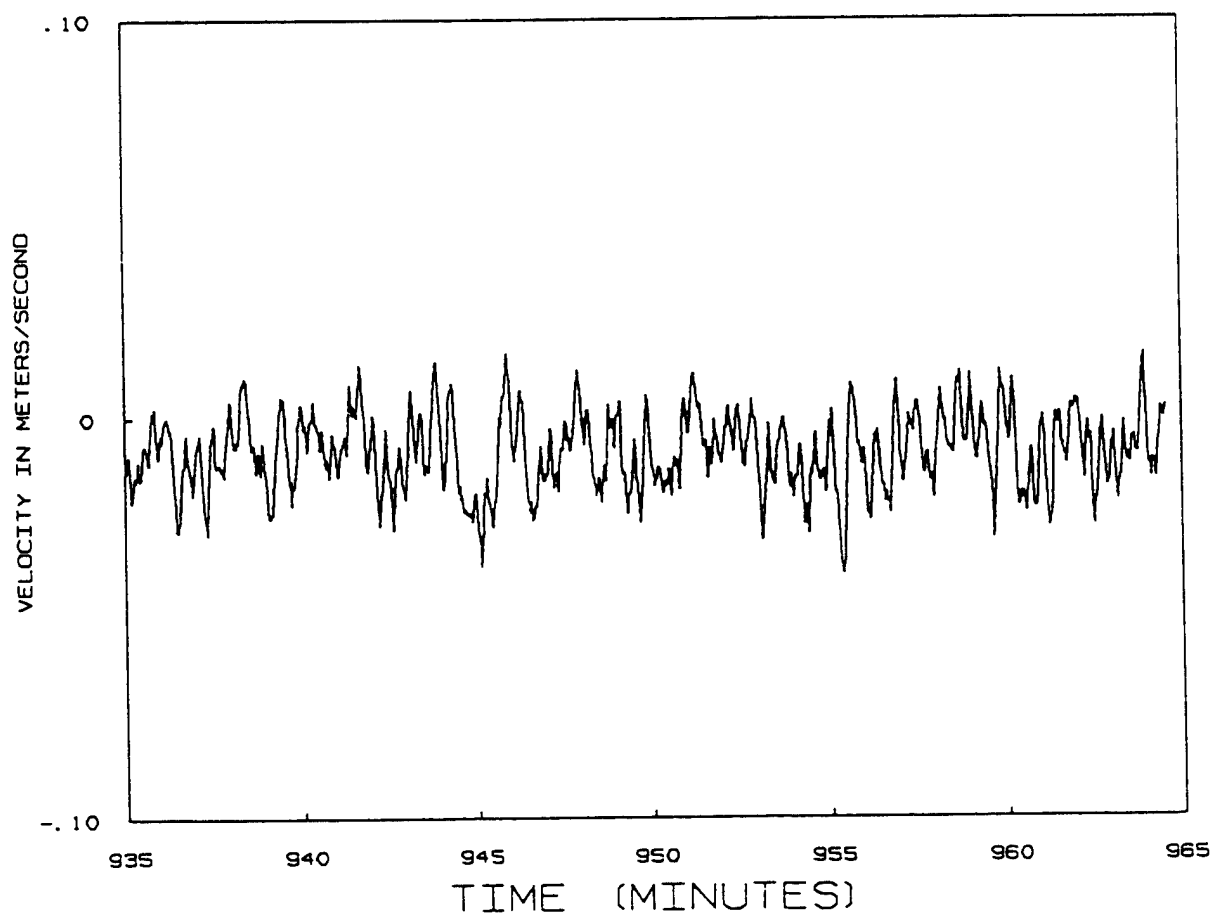
meter number	1000	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	0.35
speed	7.1 mph	vmax =	0.39 tmax = 961.
direction	upstream	vmin =	0.30 tmin = 955.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT

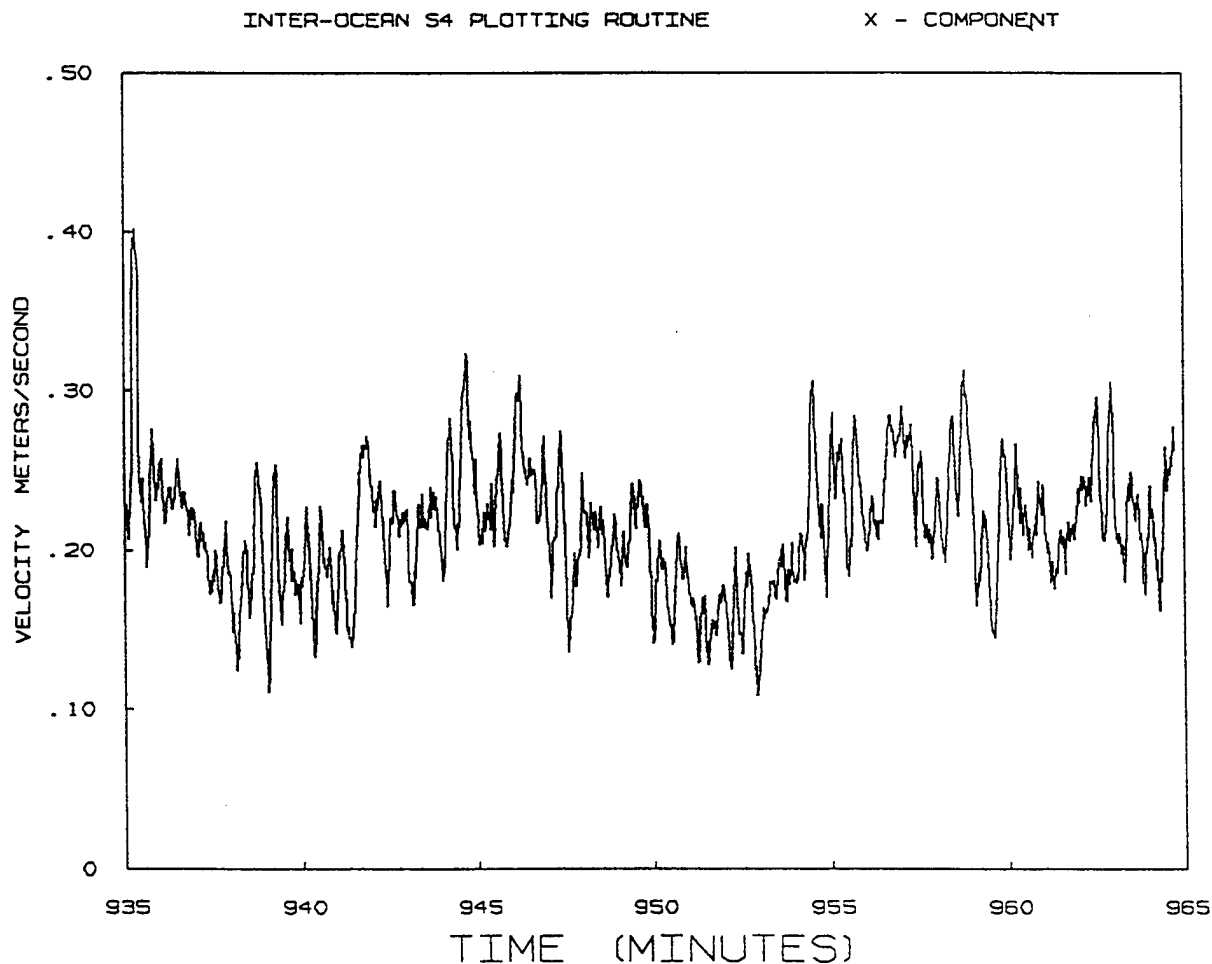


meter number	1000	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	mean =	-0.01
speed	7.1 mph	vmax =	0.02 tmax = 946.
direction	upstream	vmin =	-0.04 tmin = 955.

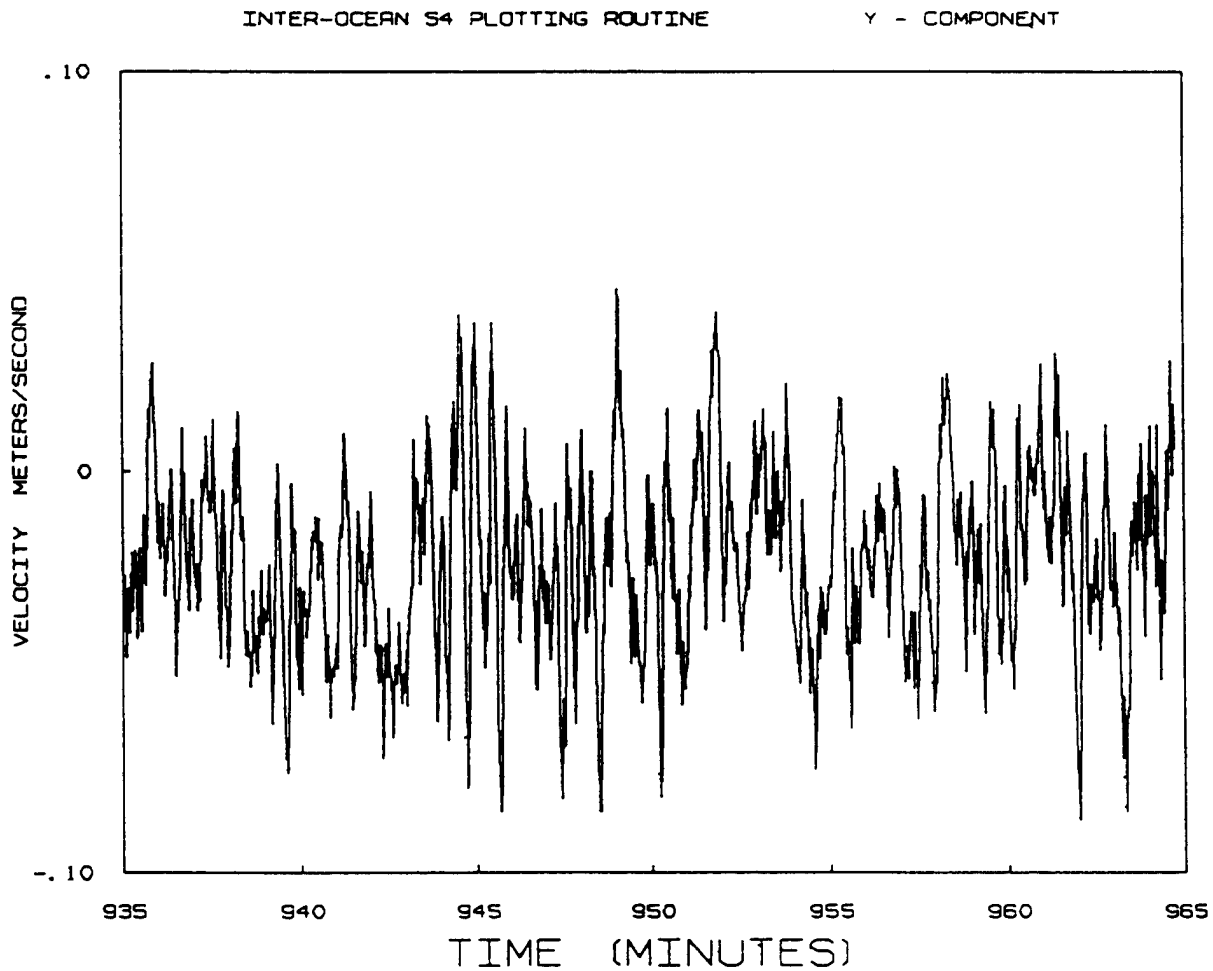
MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



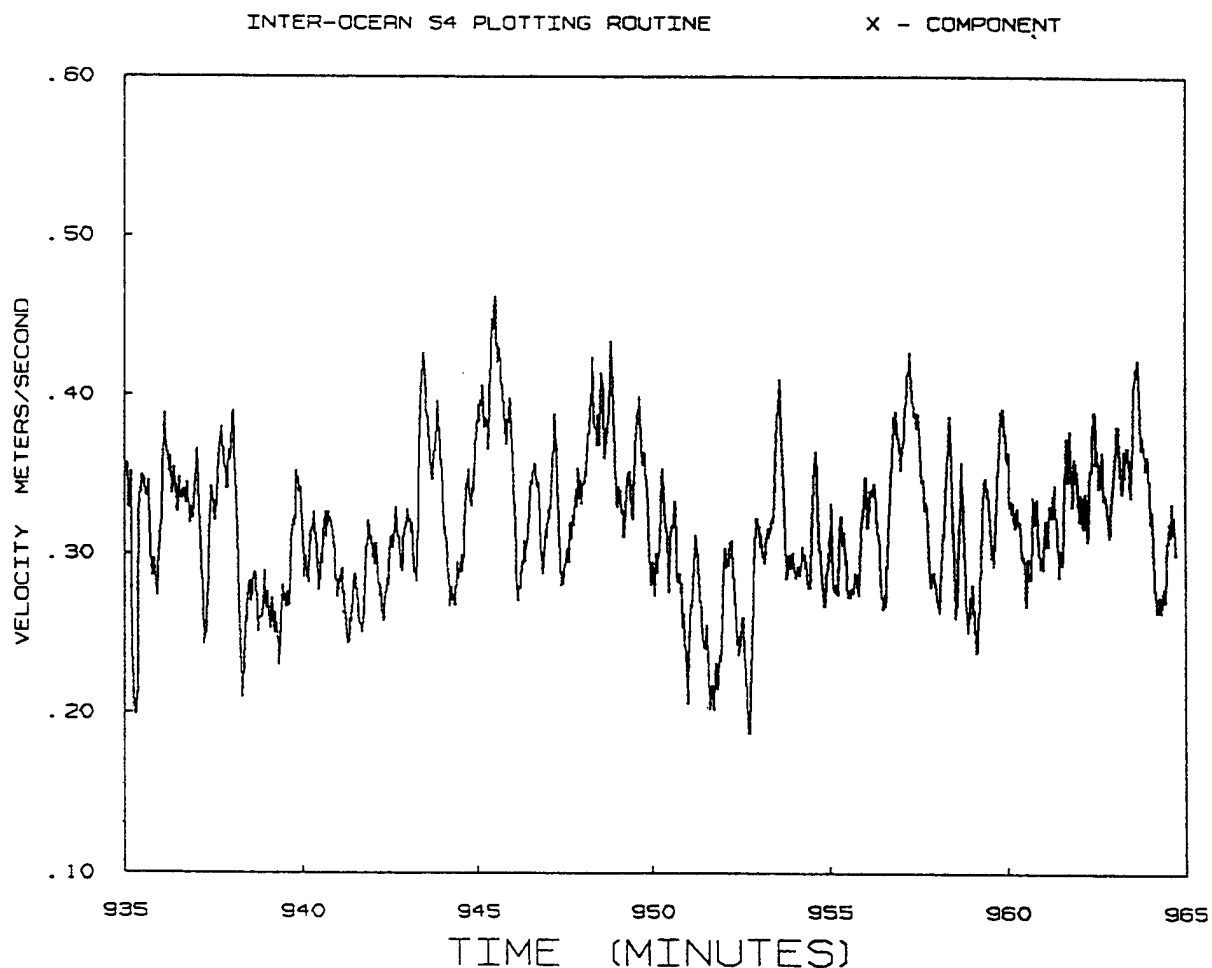
meter number	151	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN =	0.21
speed	7.1 mph	VMAX =	0.40 TMAX = 935.
direction	upstream	VMIN =	0.11 TMIN = 953.



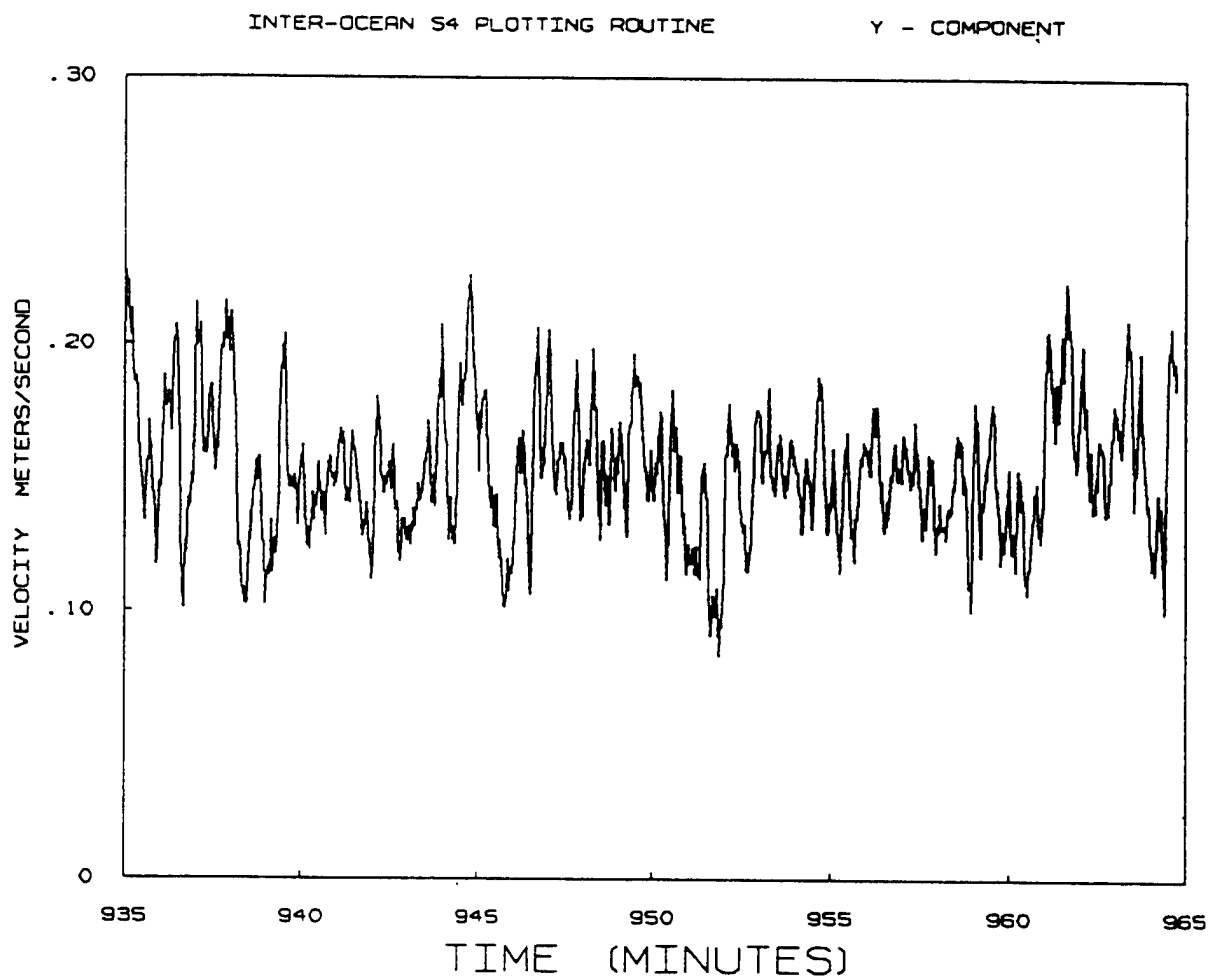
meter number	151	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN	= -0.03
speed	7.1 mph	VMAX	= 0.05 TMAX = 949.
direction	upstream	VMIN	= -0.09 TMIN = 962.



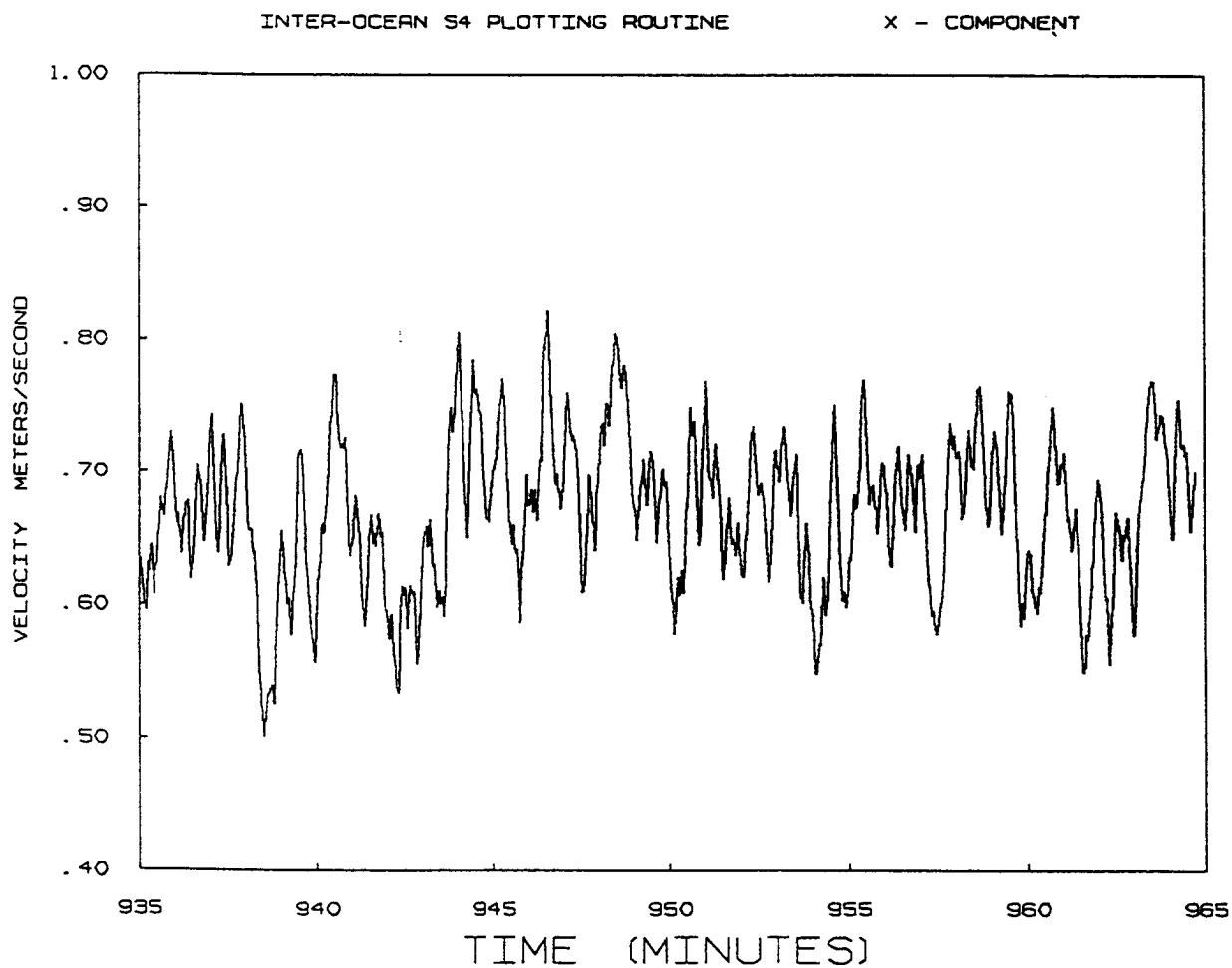
meter number	834	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN =	0.31
speed	7.1 mph	VMAX =	0.46 TMAX = 946.
direction	upstream	VMIN =	0.19 TMIN = 953.



meter number	834	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN =	0.16
speed	7.1 mph	VMAX =	0.23 TMAX = 935.
direction	upstream	VMIN =	0.08 TMIN = 952.



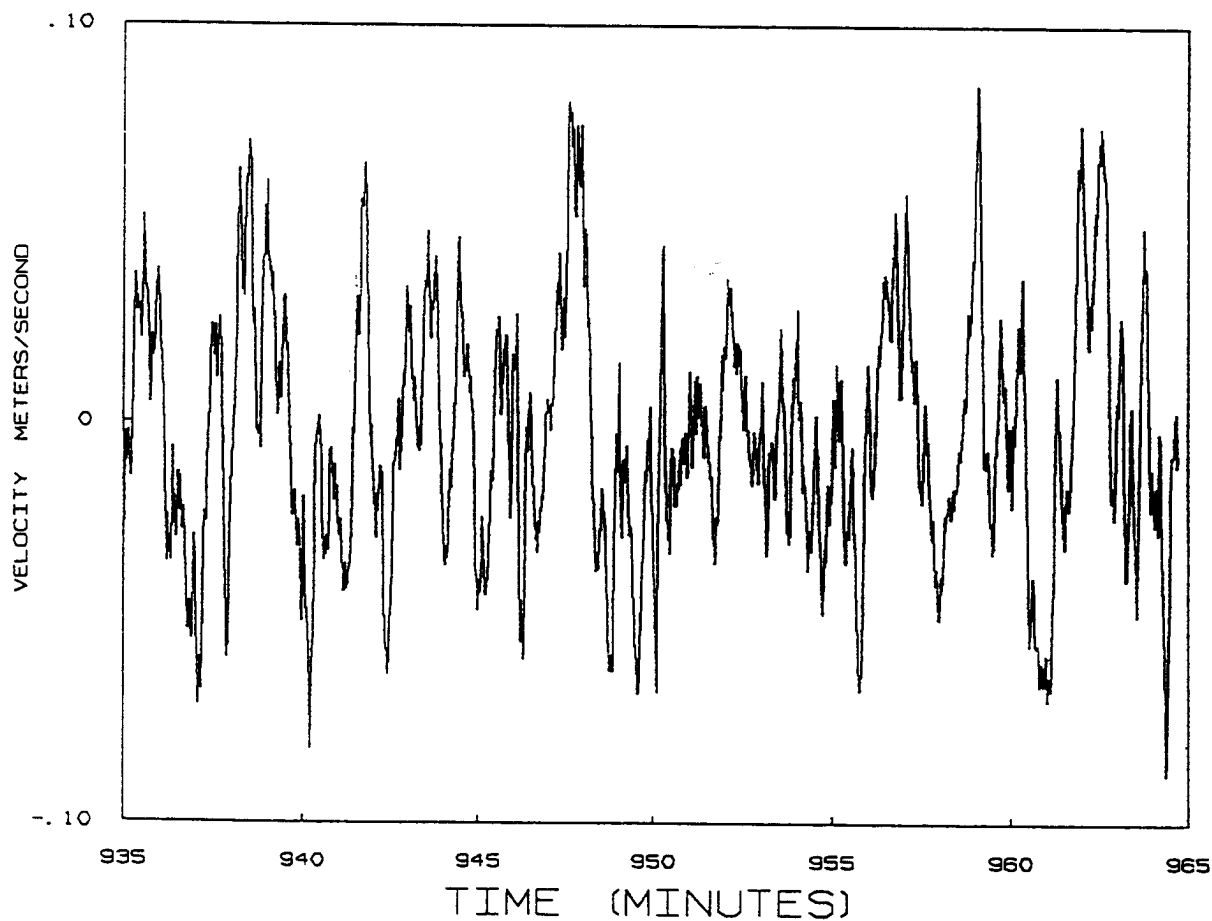
meter number	040	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN =	0.65
speed	7.1 mph	VMAX =	0.82 TMAX = 947.
direction	upstream	VMIN =	0.50 TMIN = 938.



meter number	040	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN =	0.00
speed	7.1 mph	VMAX =	0.09 TMAX = 959.
direction	upstream	VMIN =	-0.09 TMIN = 964.

INTER-OCEAN S4 PLOTTING ROUTINE

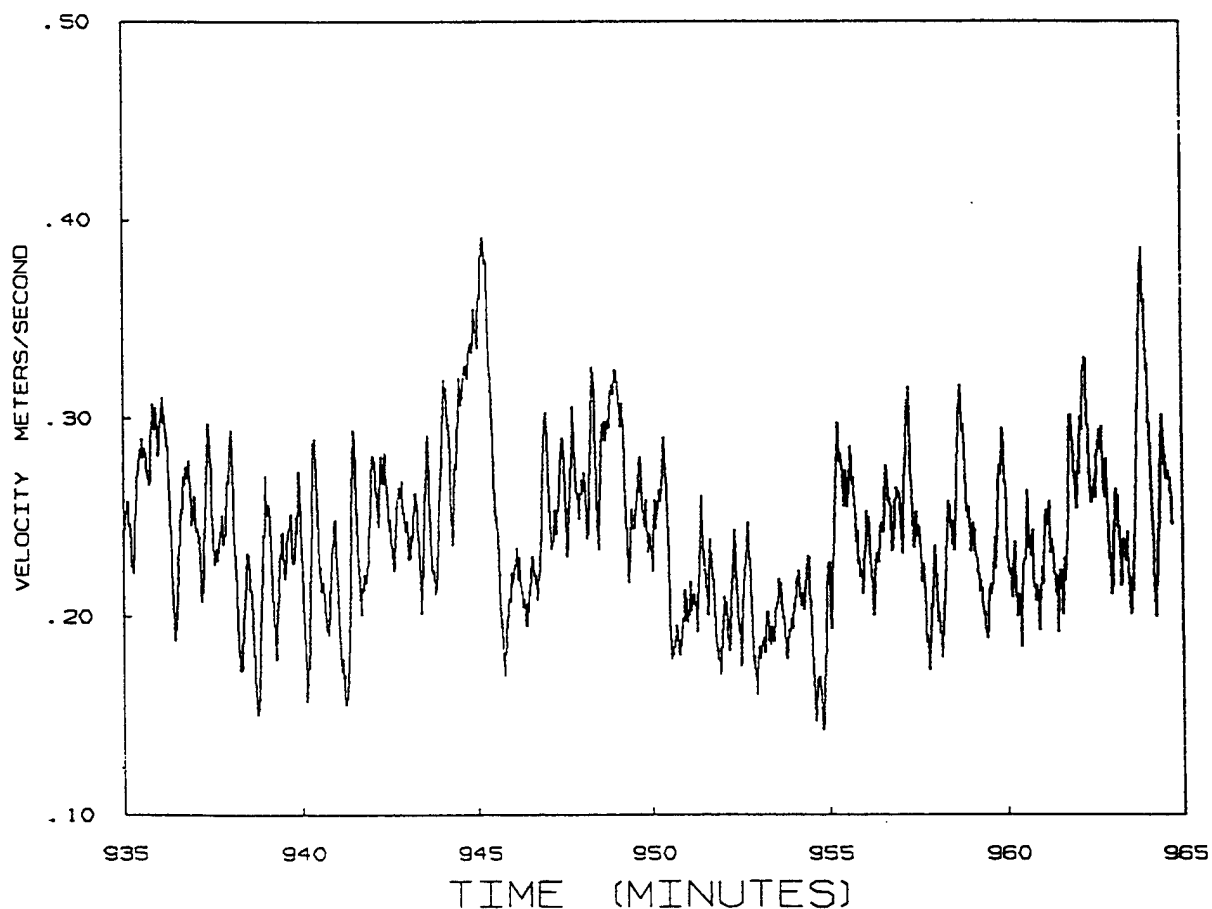
Y - COMPONENT



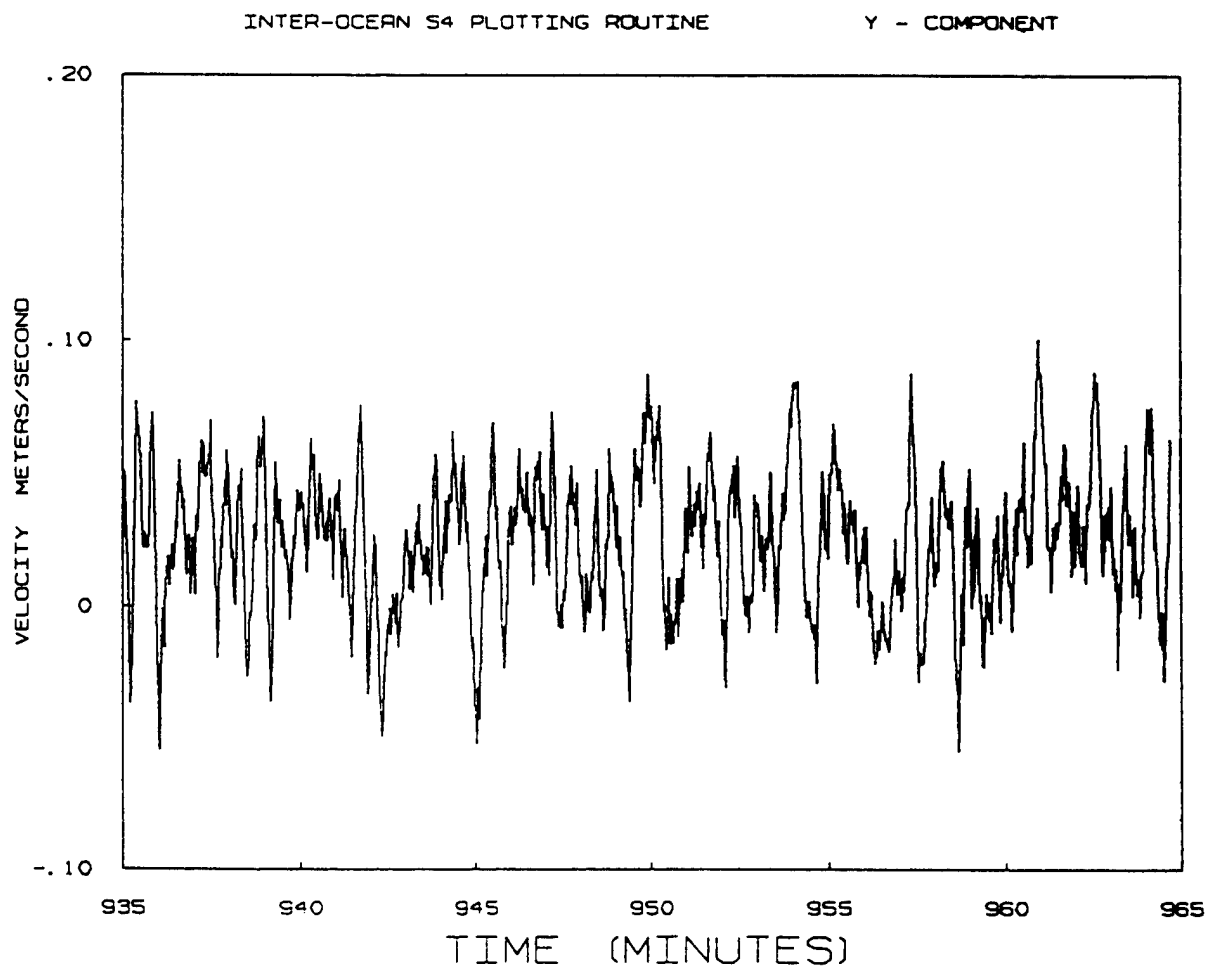
meter number	832	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN =	0.25
speed	7.1 mph	VMAX =	0.39 TMAX = 945.
direction	upstream	VMIN =	0.14 TMIN = 955.

INTER-OCEAN S4 PLOTTING ROUTINE

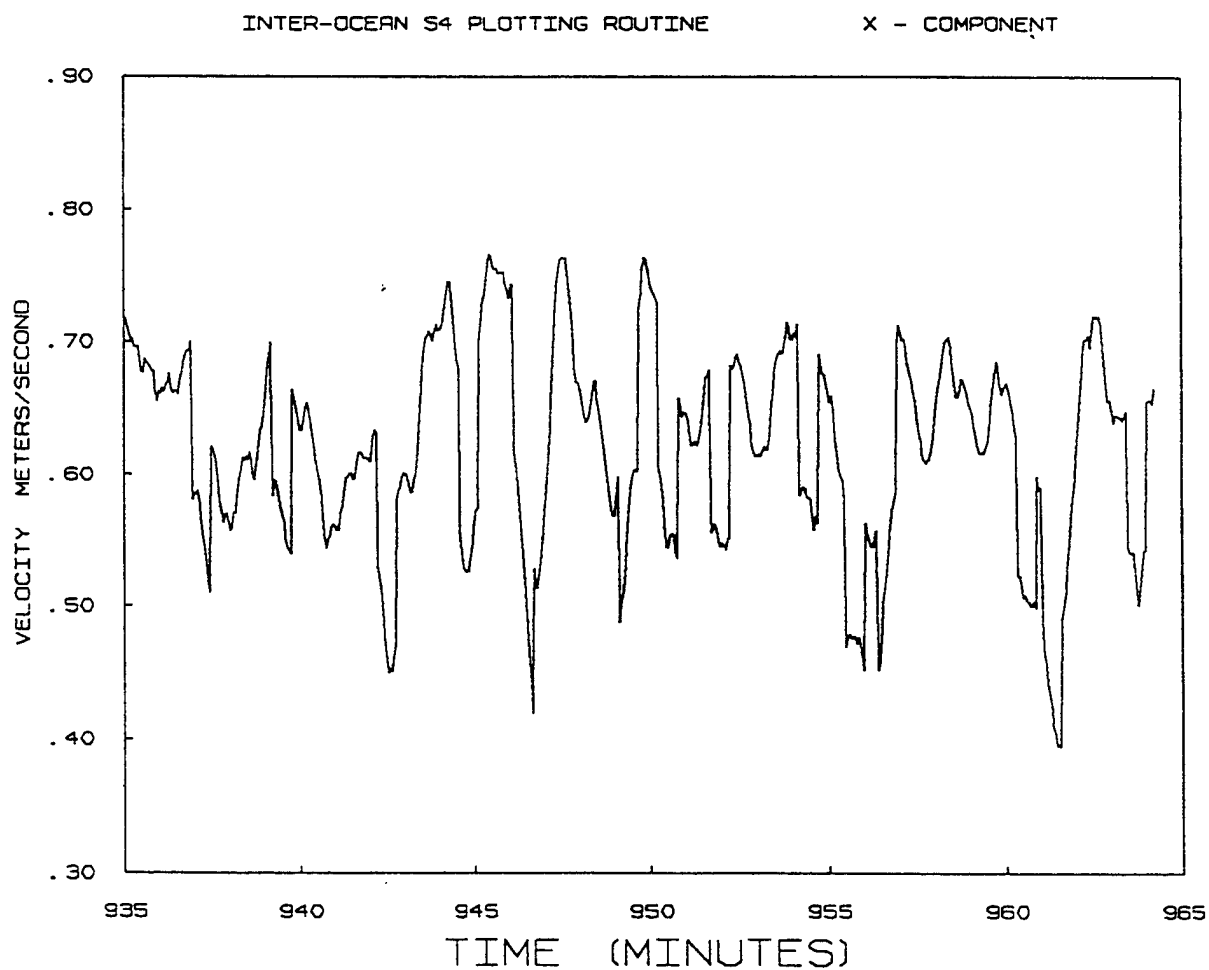
X - COMPONENT



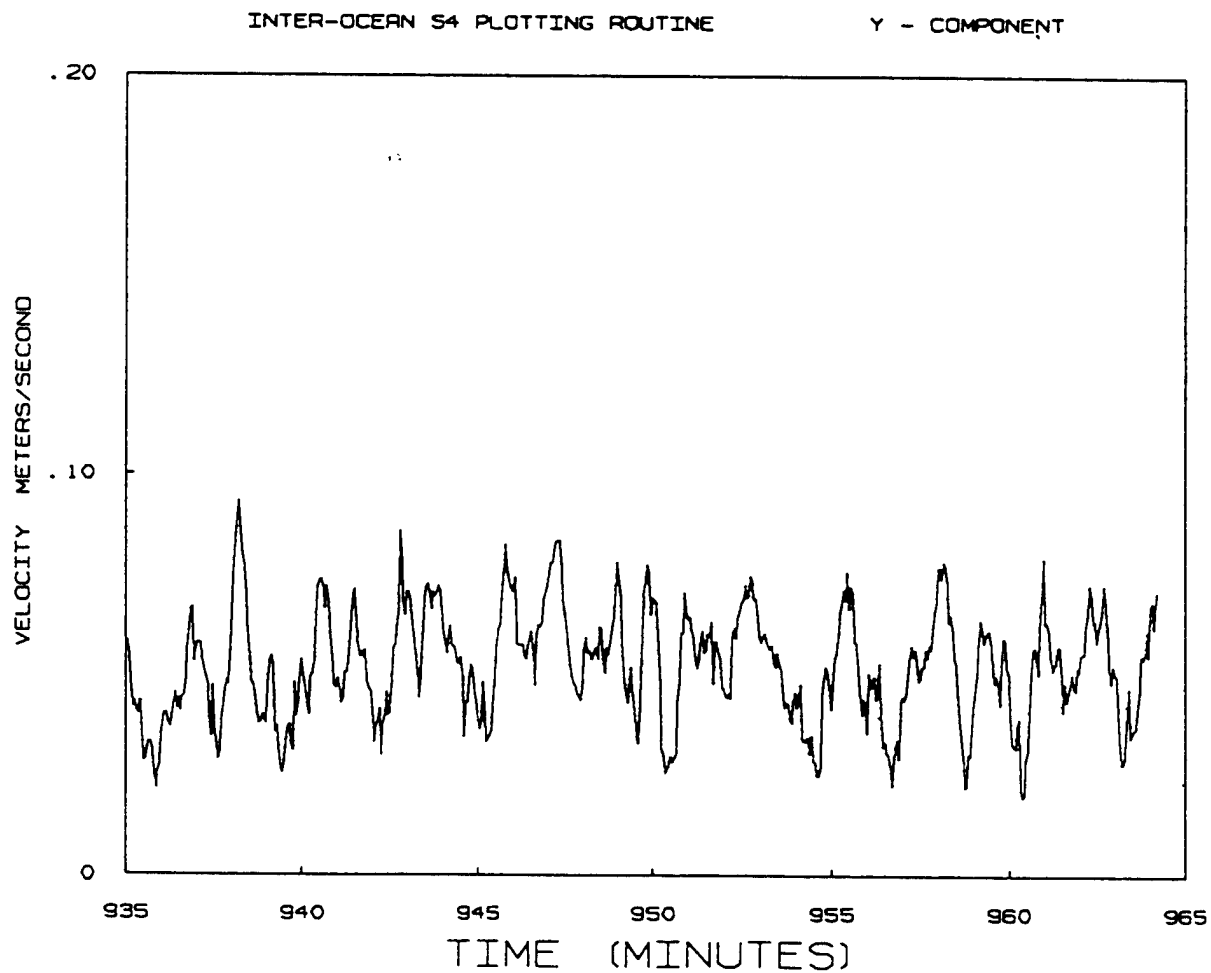
meter number	832	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN =	0.02
speed	7.1 mph	VMAX =	0.10 TMAX = 961.
direction	upstream	VMIN =	-0.06 TMIN = 959.



meter number	071	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN =	0.60
speed	7.1 mph	VMAX =	0.77 TMAX = 945.
direction	upstream	VMIN =	0.39 TMIN = 962.

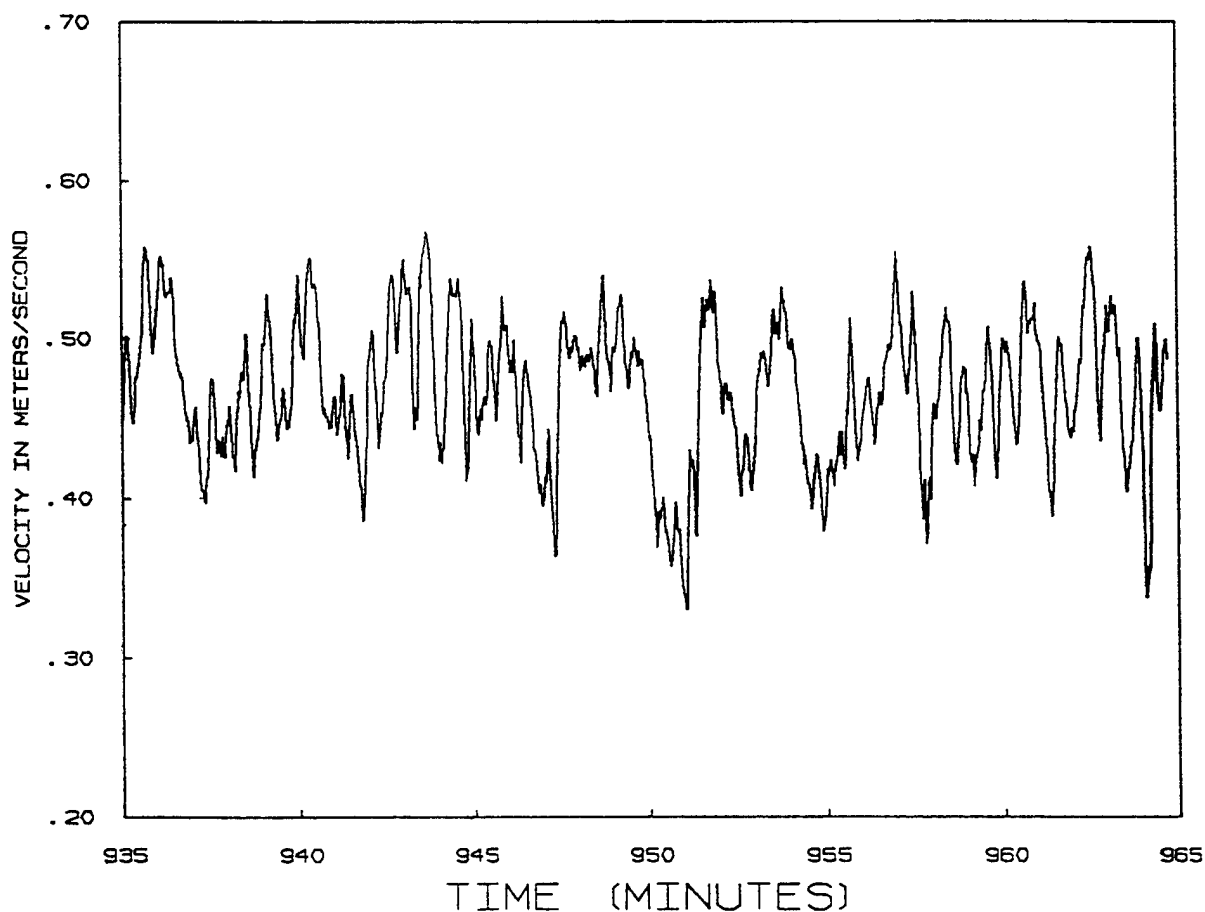


meter number	071	distance	275
tow name	American	start-time	1535
configuration	3x5	end-time	1605
draft	2.0	MEAN =	0.05
speed	7.1 mph	VMAX =	0.09 TMAX = 938.
direction	upstream	VMIN =	0.02 TMIN = 960.



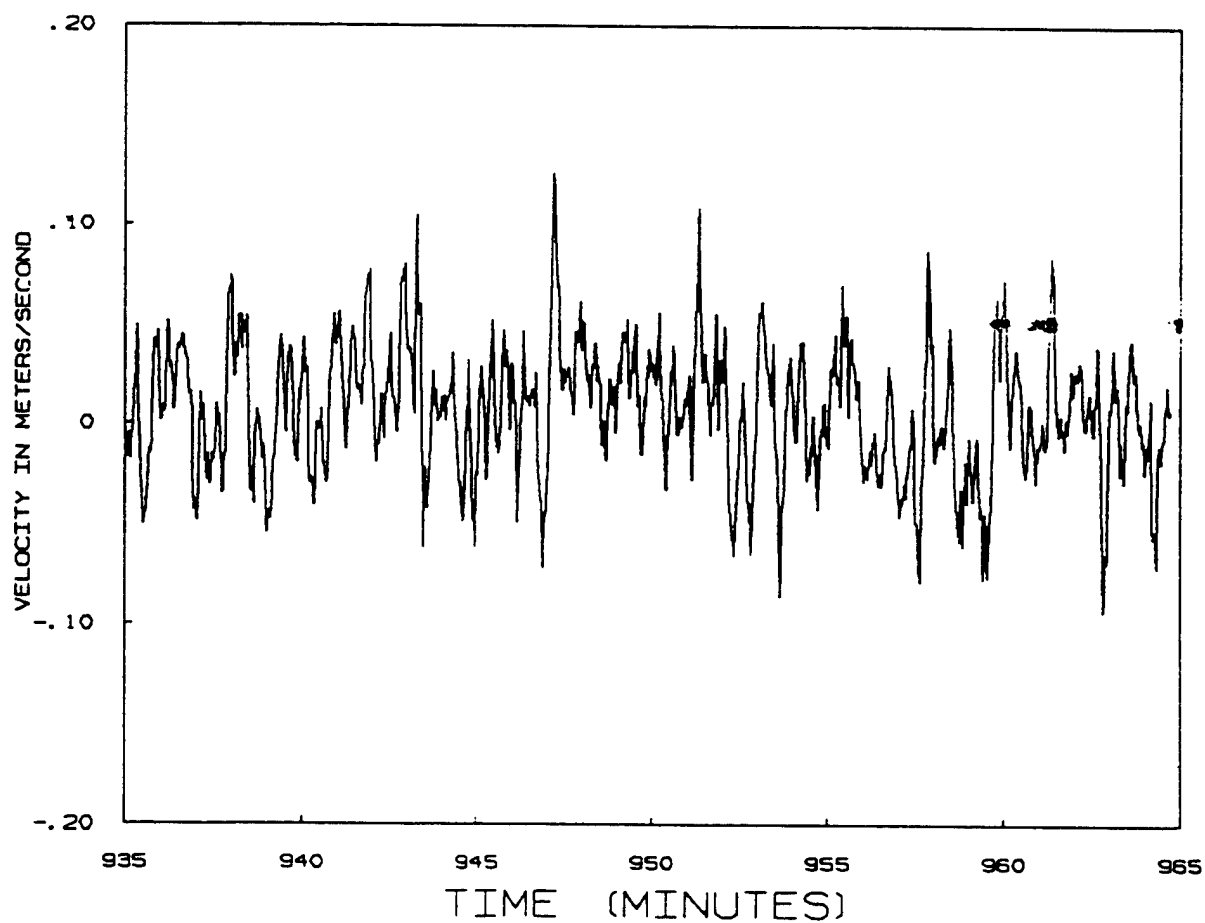
meter number	B-332	start-time	1535
tow name	American	end-time	1605
configuration	3x5	mean =	0.48
draft	2.0	vmax =	0.00 tmax = 944.
speed	7.1 mph	vmin =	0.00 tmin = 951.
direction	upstream		
distance	275		

MARSH MCBIRNEY S11/527 PLOTTING ROUTINE X - COMPONENT



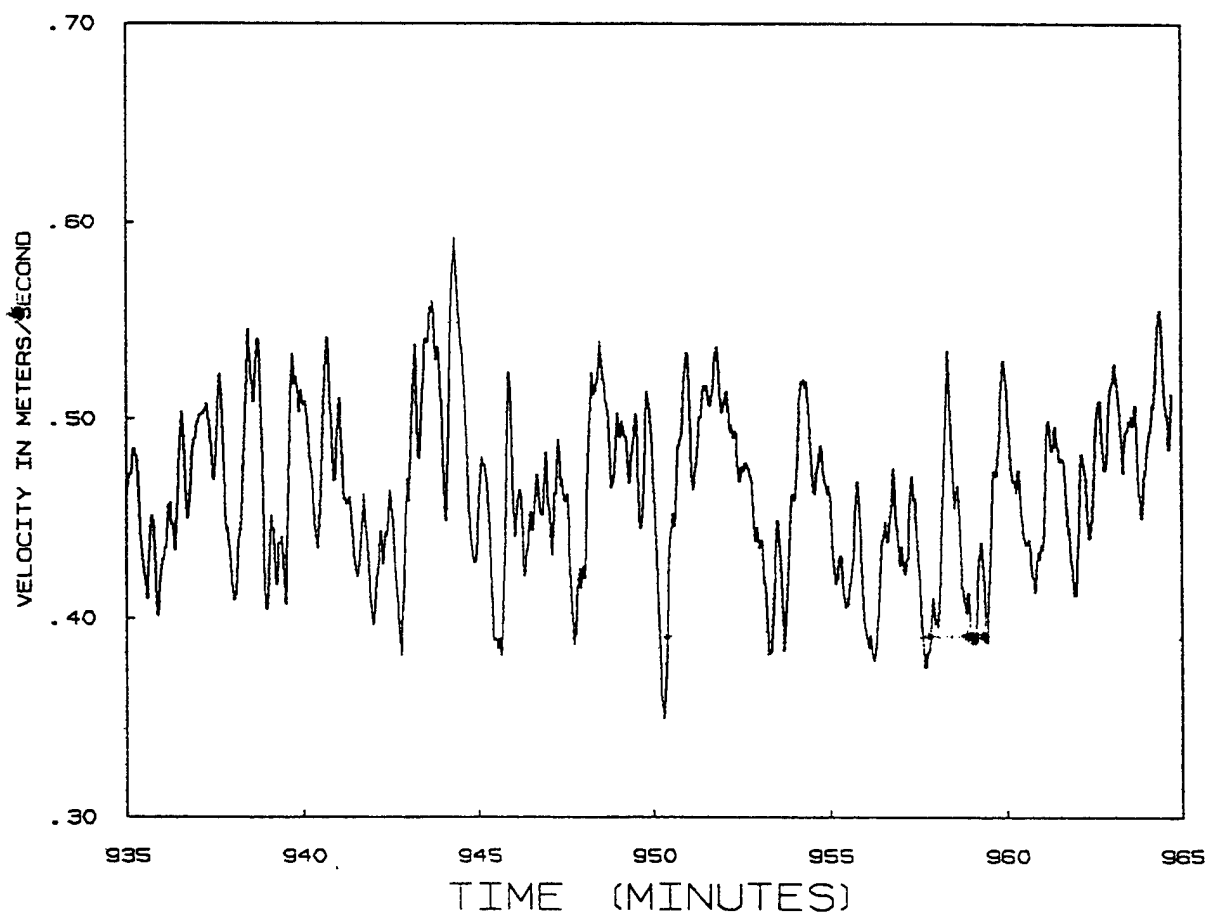
meter number	B-332	start-time	1535
tow name	American	end-time	1605
configuration	3x5	mean =	0.01
draft	2.0	vmax =	0.00 tmax = 947.
speed	7.1 mph	vmin =	0.00 tmin = 963.
direction	upstream		
distance	275		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



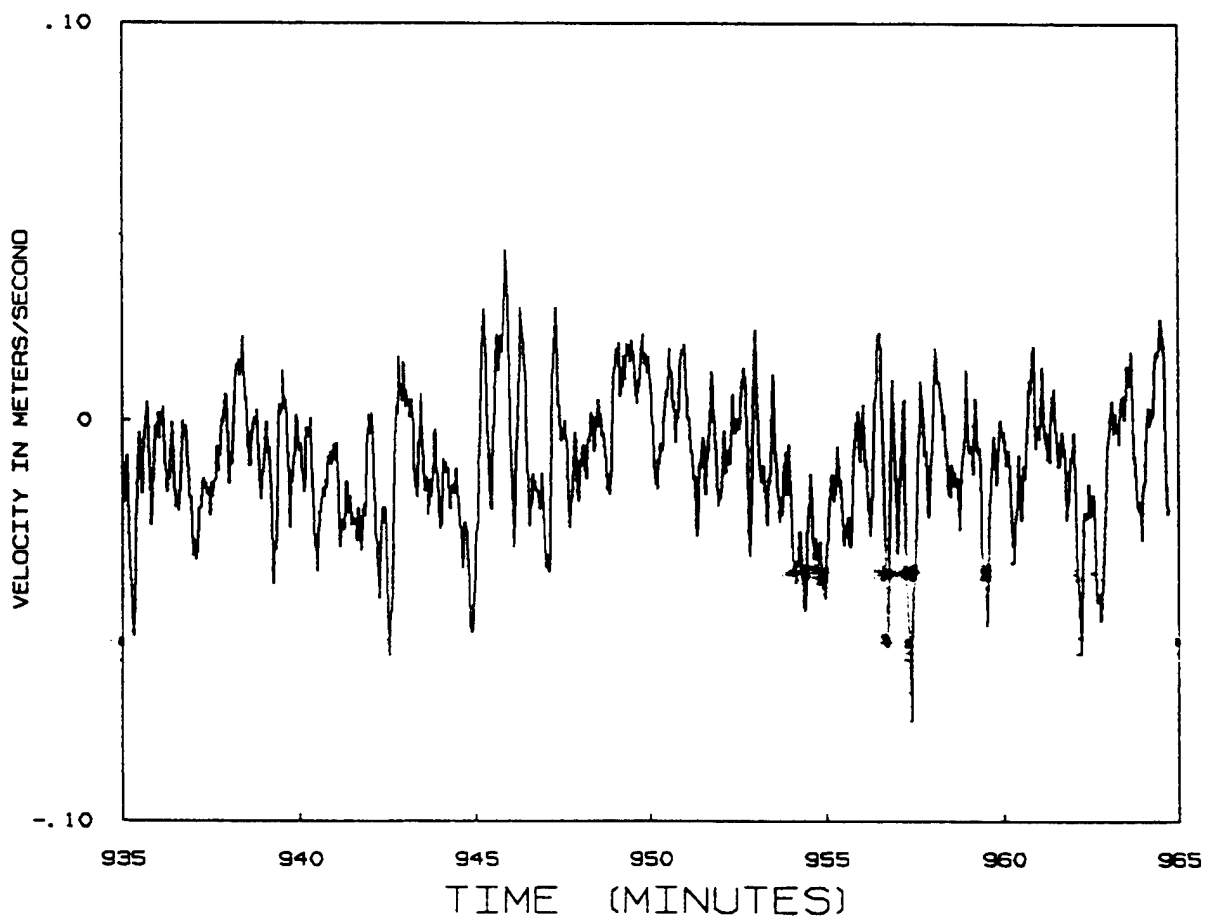
meter number	B-642	start-time	1535
tow name	American	end-time	1605
configuration	3x5	mean =	0.47
draft	2.0	vmax =	0.00 tmax = 944.
speed	7.1 mph	vmin =	0.00 tmin = 950.
direction	upstream		
distance	275		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



meter number	B-642	start-time	1535
tow name	American	end-time	1605
configuration	3x5	mean	= -0.01
draft	2.0	vmax	= 0.00 tmax = 946.
speed	7.1 mph	vmin	= 0.00 tmin = 957.
direction	upstream		
distance	275		

MARSH MCBIRNEY S11/527 PLOTTING ROUTINE Y - COMPONENT



XX-6. Velocity fluctuations measured by two-dimensional current meters
for barge *James F. Neal* at Goose Island, trip 2

James F. Neal (7/18/91)

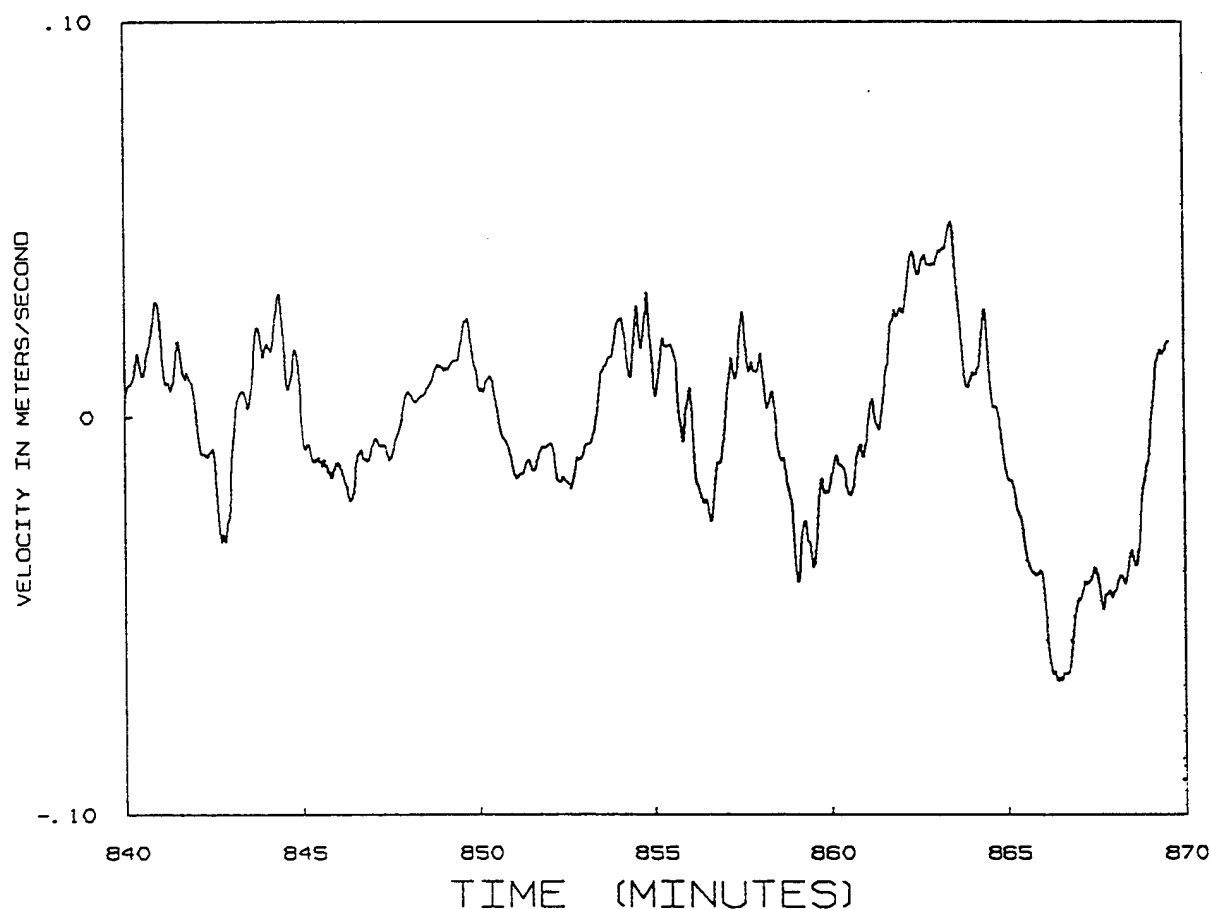
Status of Electromagnetic Current Meters:

998 (MMB511) ✓	1000 (MMB511) ✓	999 (MMB511) ✓	1130 (MMB511) ✓	1131 (MMB511) ✓	1001 (MMB511) ✓
642 (MMB527) ✓	332 (MMB527) ✓				
071 (S4) ✓	834 (S4) ✓	040 (S4) ✓	832 (S4) -	151 (S4) ✓	

Note: ✓ : Working
* : Not working
- : Unavailable

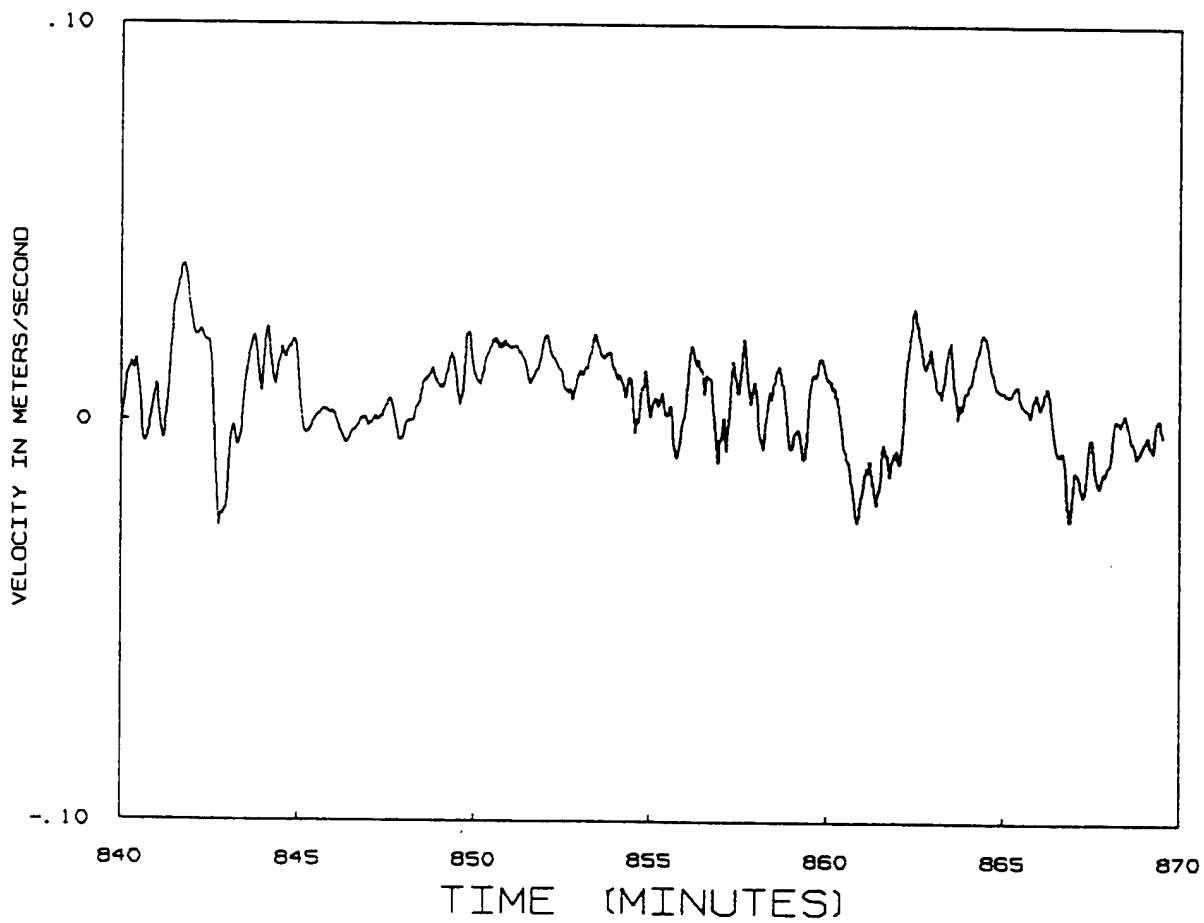
meter number	998	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.00
speed	9.1 mph	vmax =	0.05 tmax = 863.
direction	downstream	vmin =	-0.07 tmin = 866.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



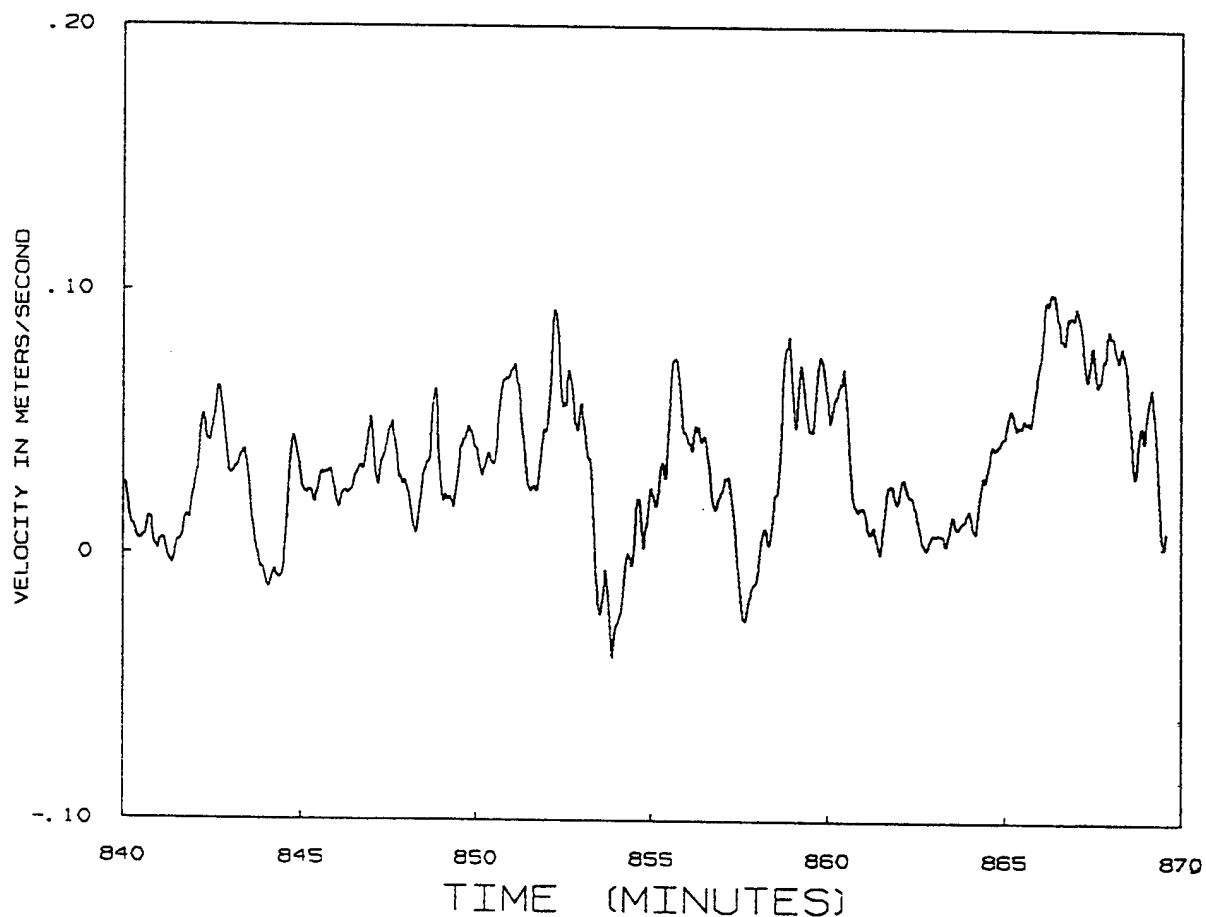
meter number	998	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.01
speed	9.1 mph	vmax =	0.04 tmax = 842.
direction	downstream	vmin =	-0.03 tmin = 843.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



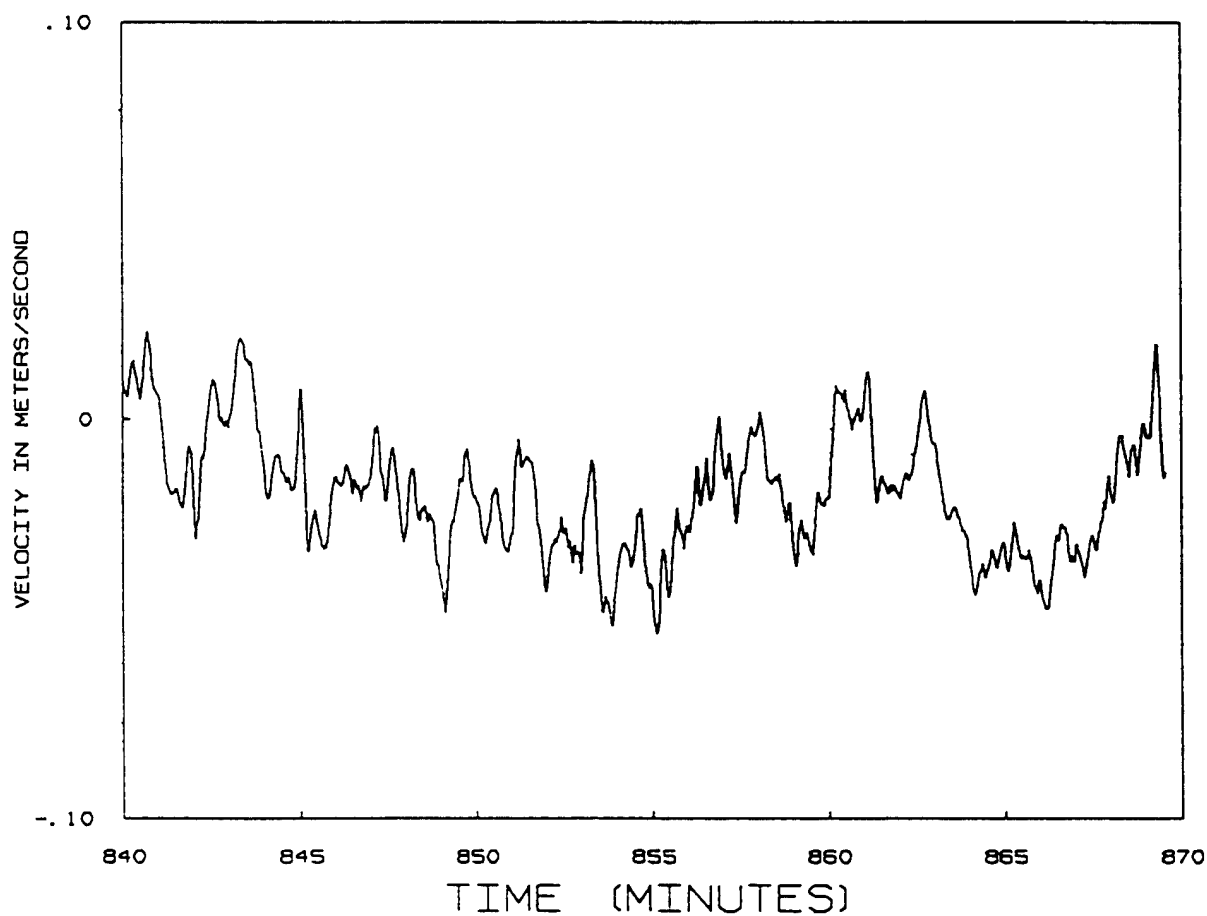
meter number	1000	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.02
speed	9.1 mph	vmax =	0.10 tmax = 866.
direction	downstream	vmin =	-0.04 tmin = 854.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



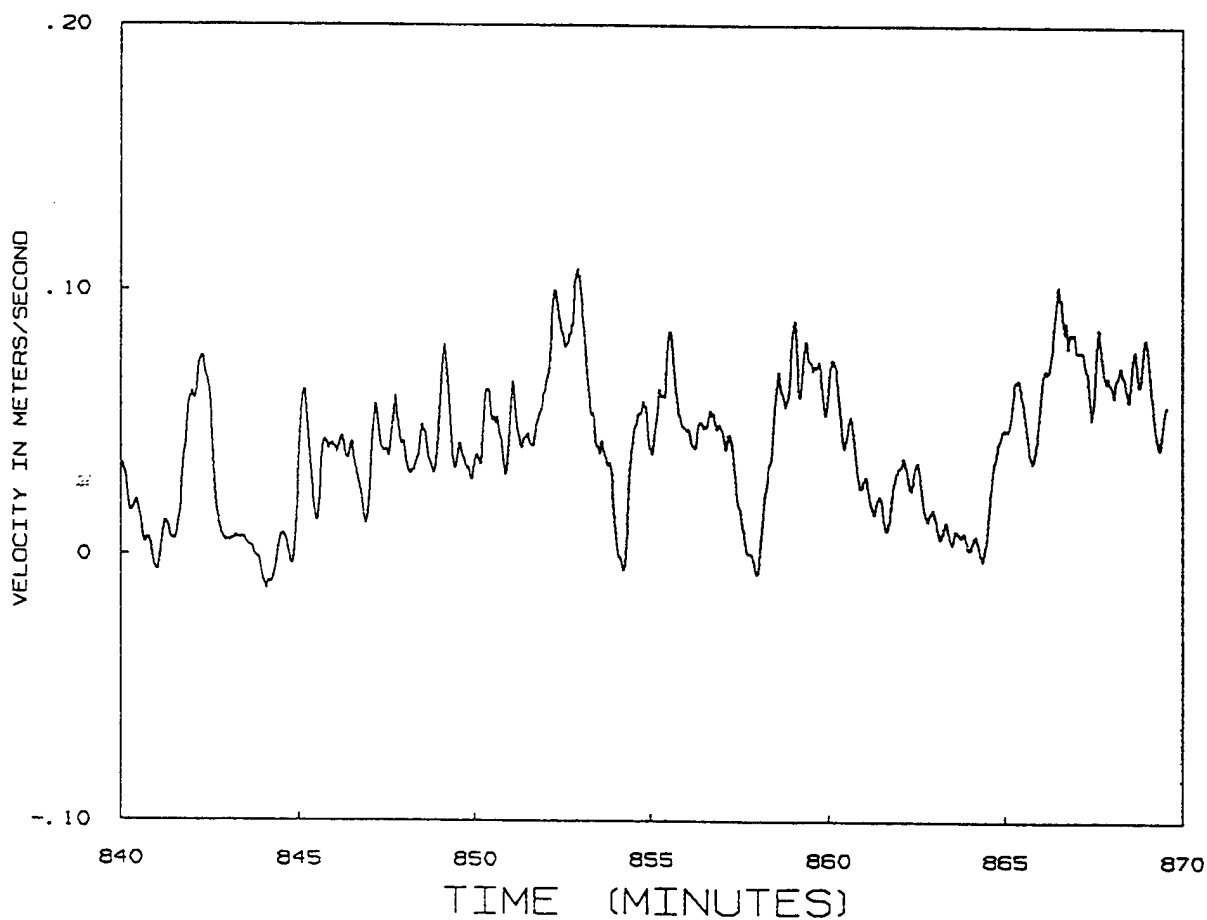
meter number	1000	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	-0.01
speed	9.1 mph	vmax =	0.02 tmax = 841.
direction	downstream	vmin =	-0.05 tmin = 855.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT

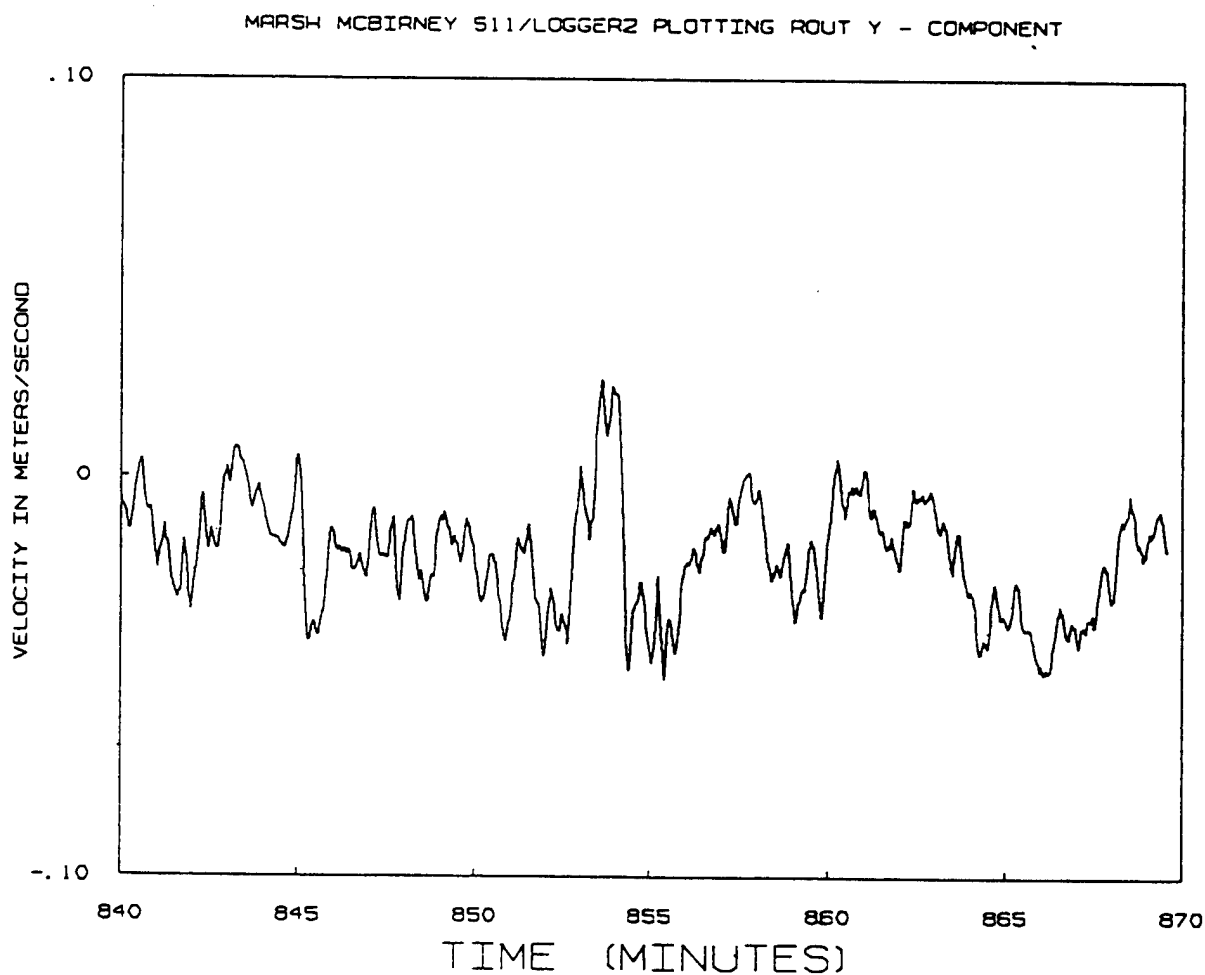


meter number	999	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.03
speed	9.1 mph	vmax =	0.11 tmax = 853.
direction	downstream	vmin =	-0.01 tmin = 844.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT

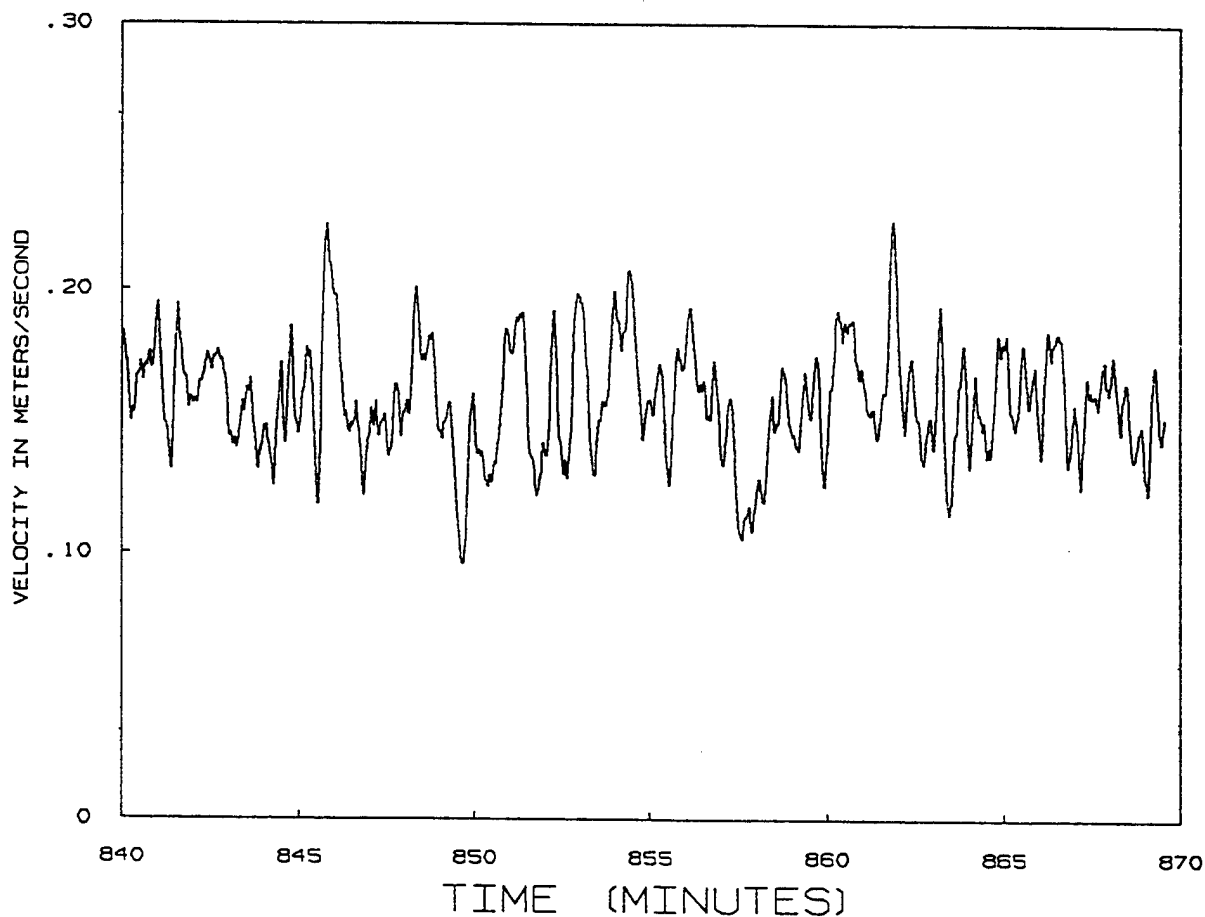


meter number	999	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	-0.02
speed	9.1 mph	vmax =	0.02 tmax = 854.
direction	downstream	vmin =	-0.05 tmin = 855.



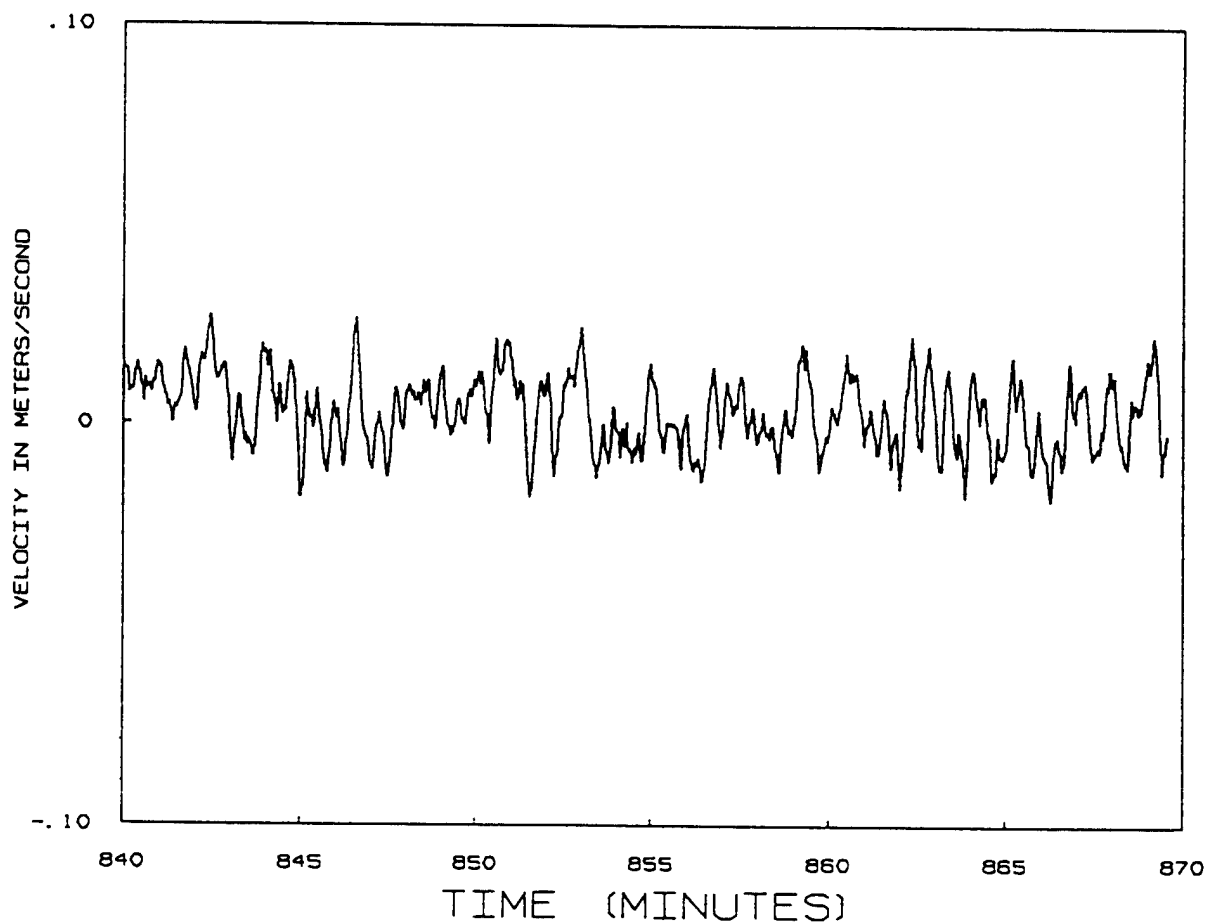
meter number	1130	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.16
speed	9.1 mph	vmax =	0.23 tmax = 862.
direction	downstream	vmin =	0.10 tmin = 850.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



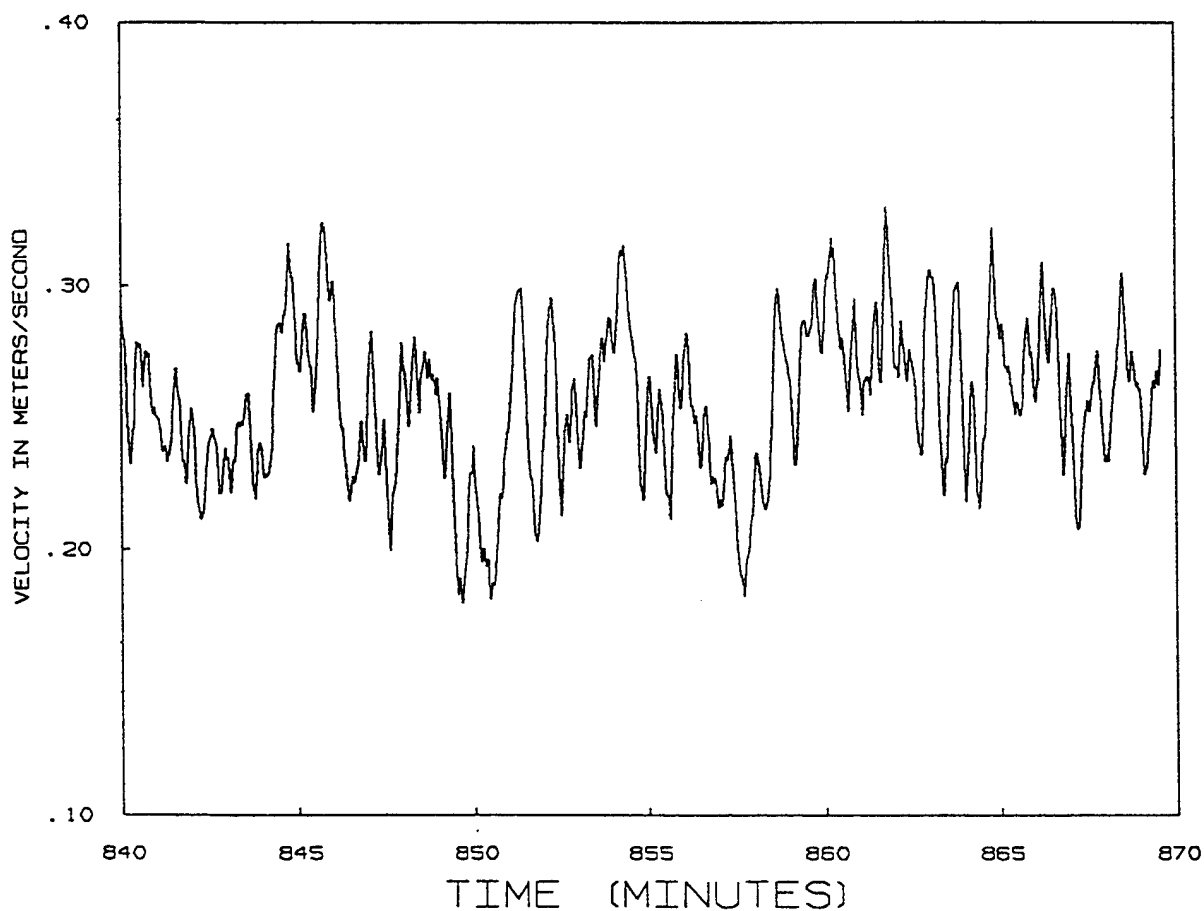
meter number	1130	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.01
speed	9.1 mph	vmax =	0.03 tmax = 842.
direction	downstream	vmin =	-0.02 tmin = 866.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



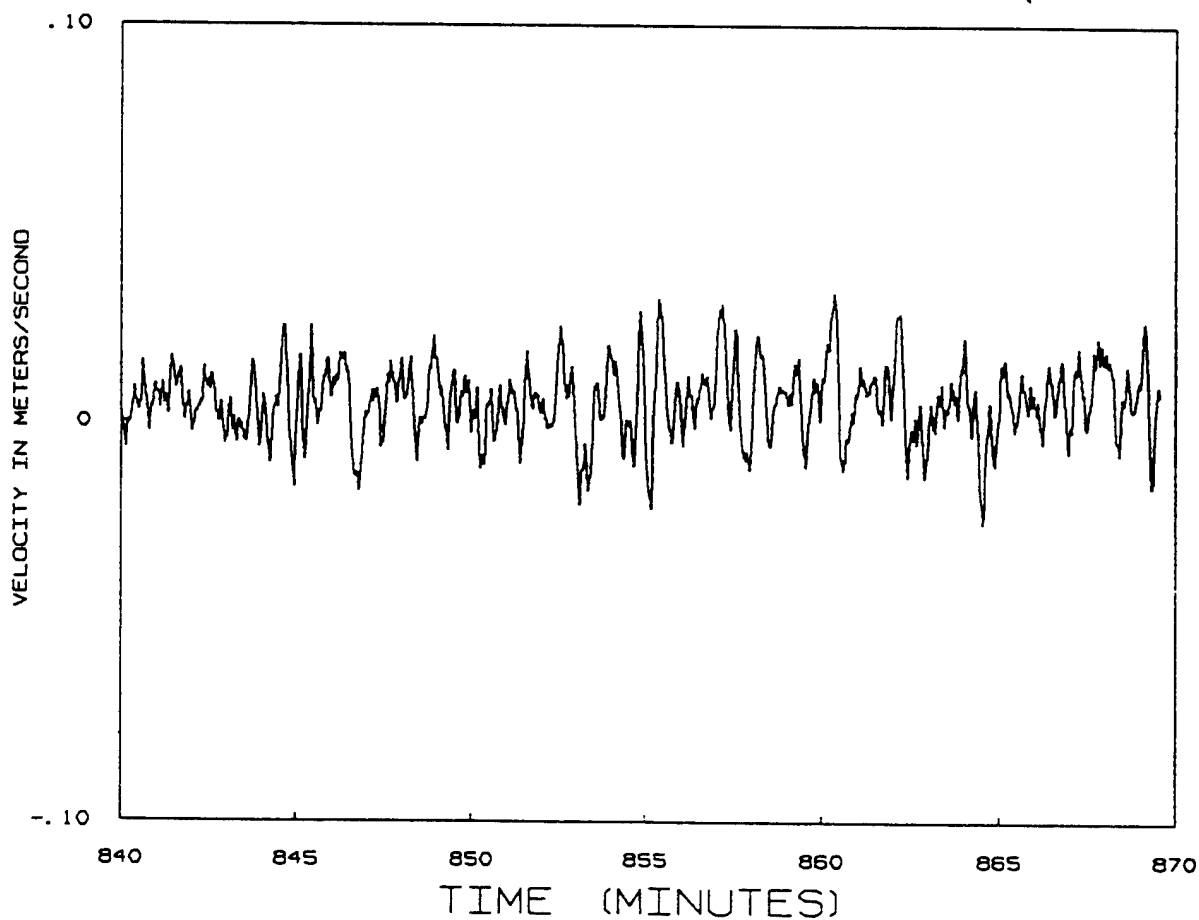
meter number	1131	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.25
speed	9.1 mph	vmax =	0.33 tmax = 862.
direction	downstream	vmmin =	0.18 tmin = 850.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



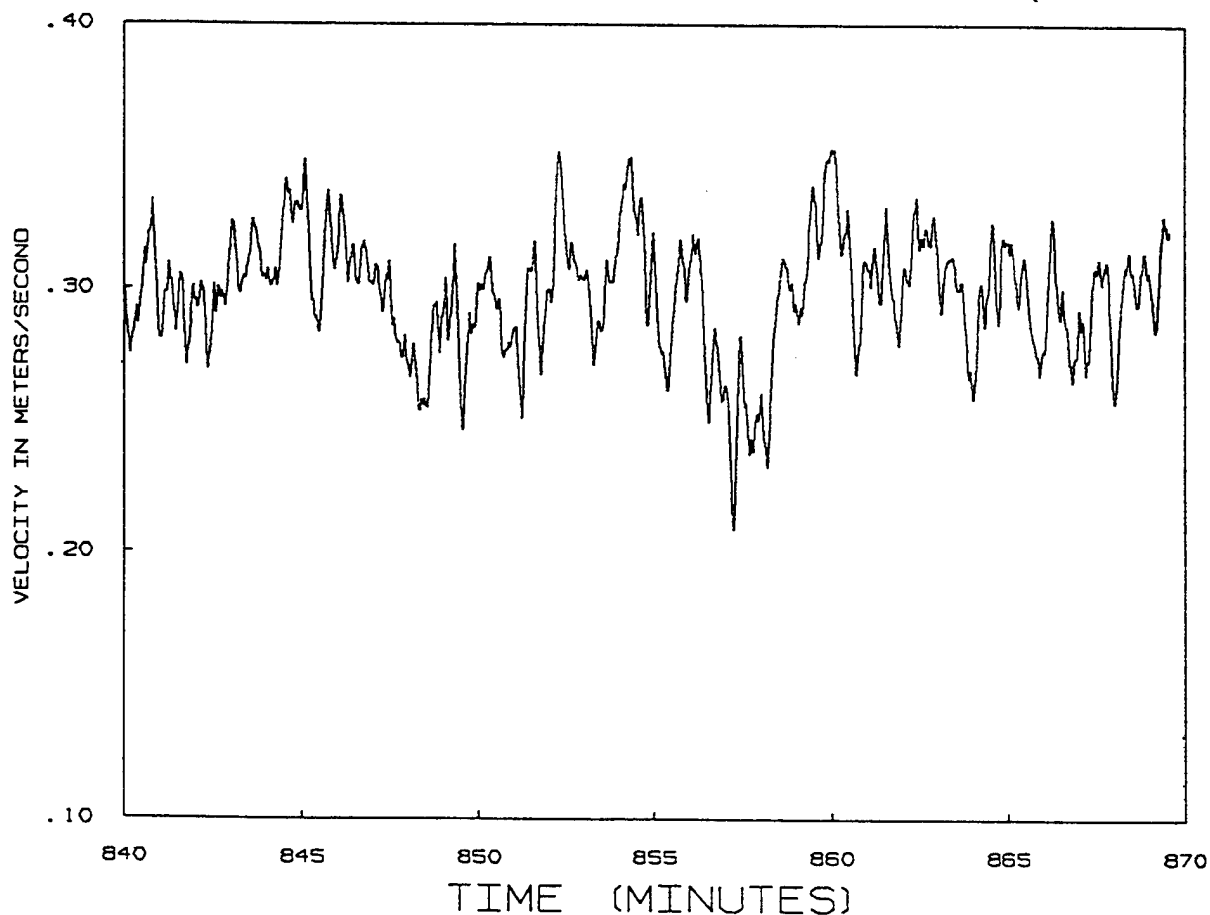
meter number	1131	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.00
speed	9.1 mph	vmax =	0.03 tmax = 860.
direction	downstream	vmin =	-0.03 tmin = 865.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



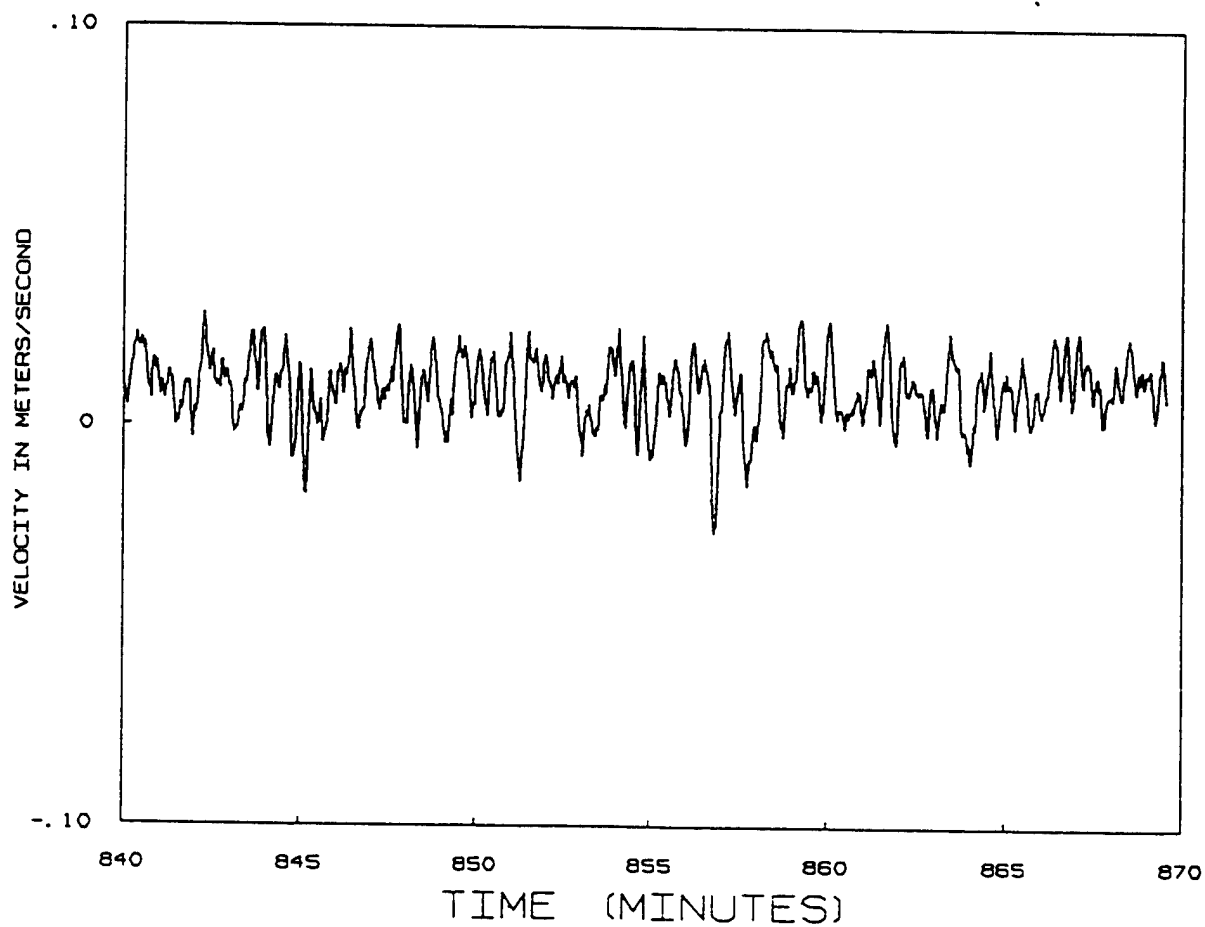
meter number	1001	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.30
speed	9.1 mph	vmax =	0.35 tmax = 860.
direction	downstream	vmin =	0.21 tmin = 857.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



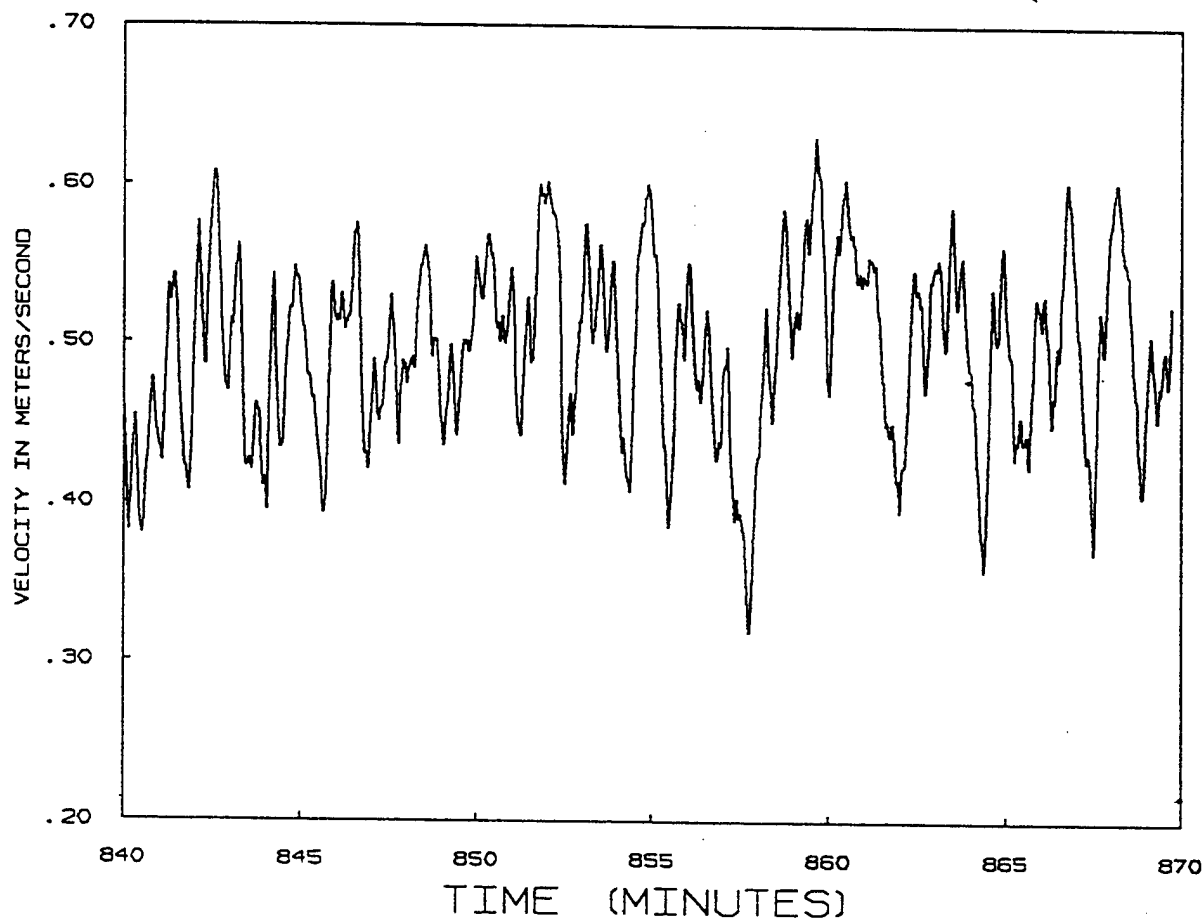
meter number	1001	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	mean =	0.01
speed	9.1 mph	vmax =	0.03 tmax = 842.
direction	downstream	vmin =	-0.03 tmin = 857.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



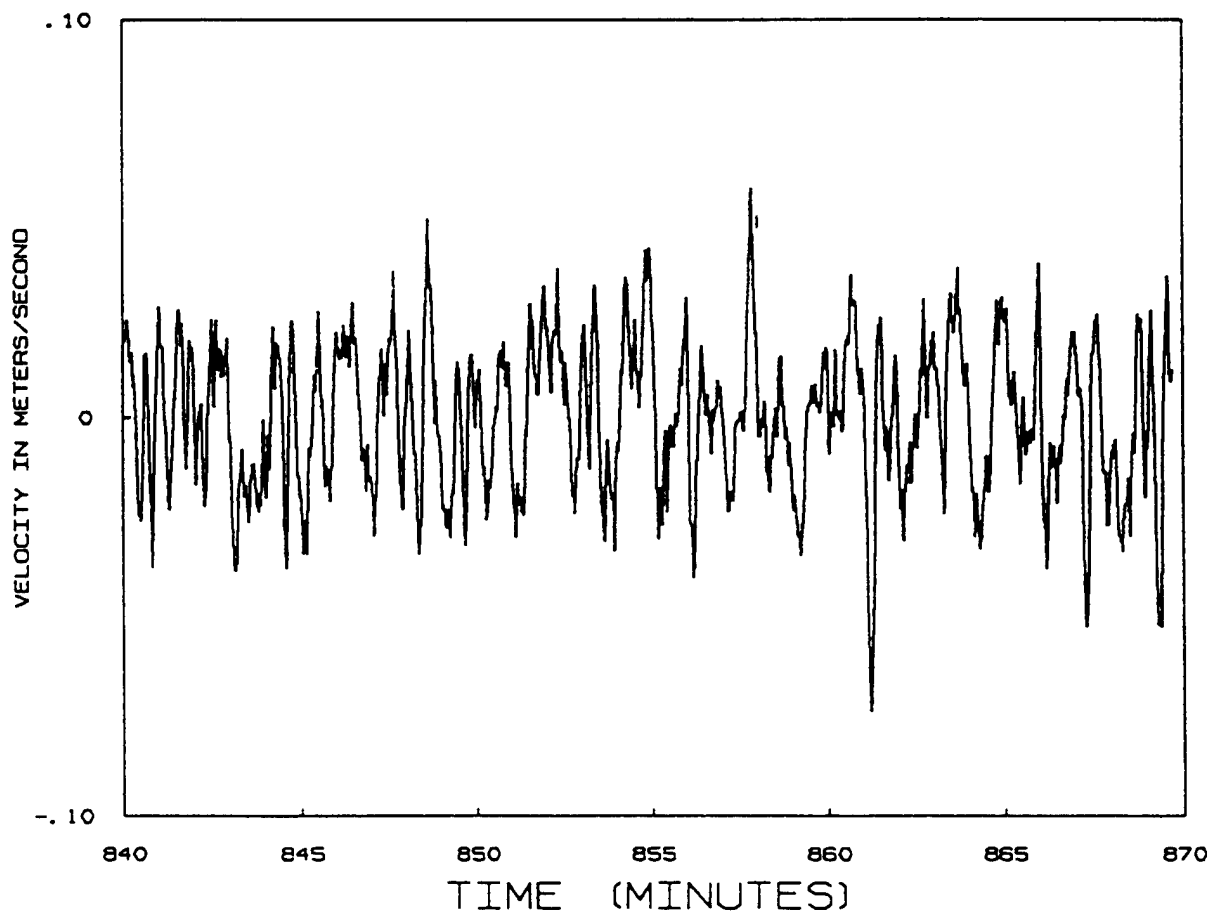
meter number	B-642	start-time	1400
tow name	james F.	end-time	1430
configuration	3x5	mean =	0.48
draft	9.0	vmax =	0.00 tmax = 860.
speed	9.1 mph	vmin =	0.00 tmin = 858.
direction	downstream		
distance	310		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



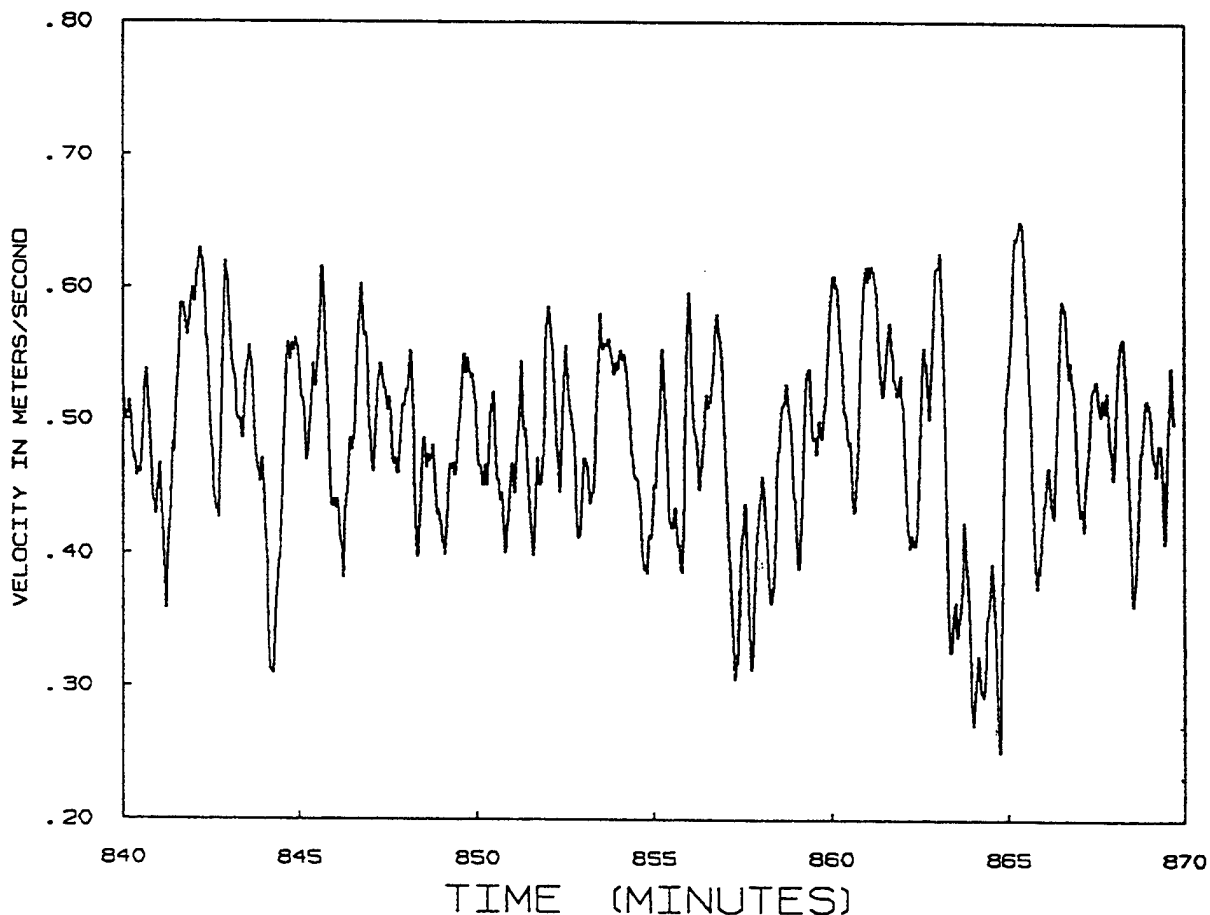
meter number	B-642	start-time	1400
tow name	james F.	end-time	1430
configuration	3x5	mean =	0.00
draft	9.0	vmax =	0.00 tmax = 858.
speed	9.1 mph	vmin =	0.00 tmin = 861.
direction	downstream		
distance	310		

MARSH MCBIRNEY S11/527 PLOTTING ROUTINE Y - COMPONENT



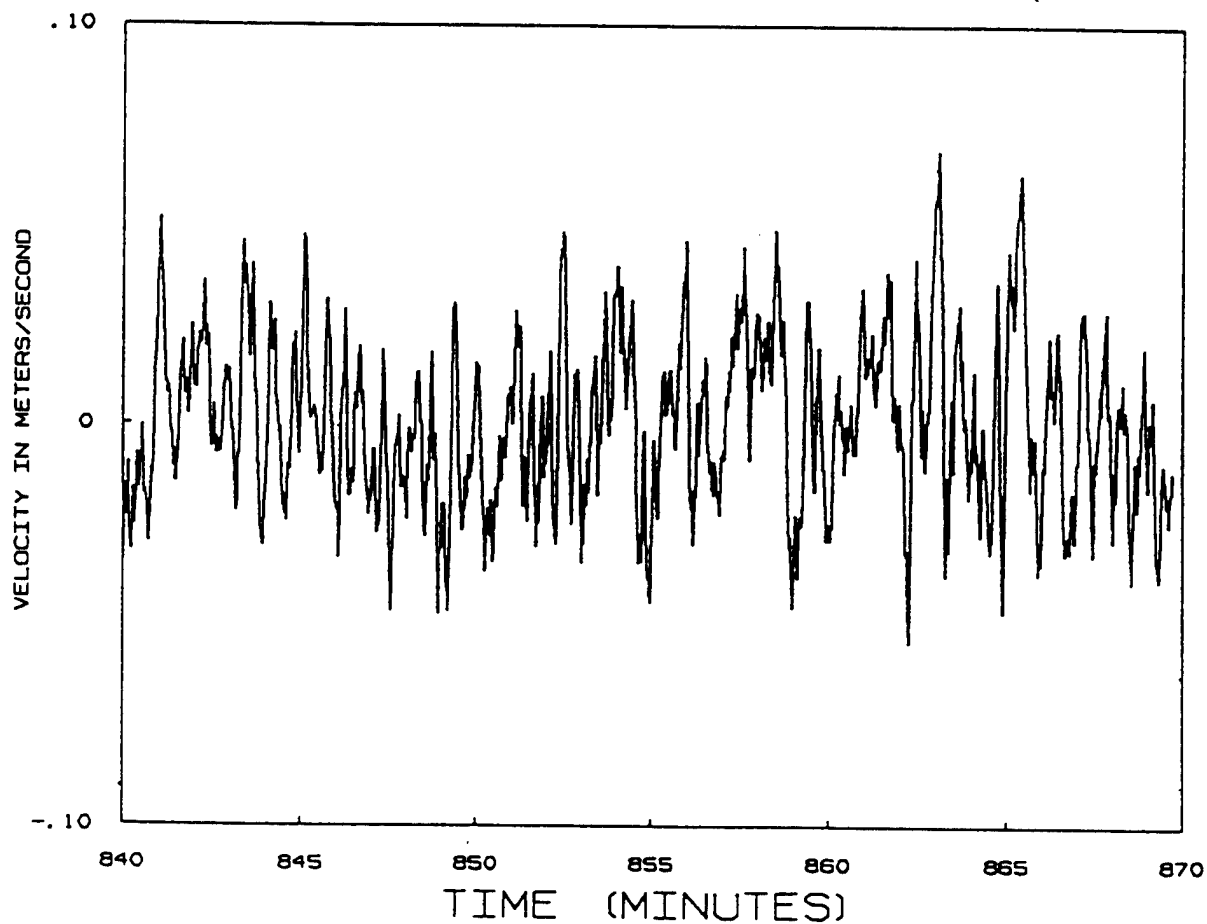
meter number	B-332	start-time	1400
tow name	james F.	end-time	1430
configuration	3x5	mean =	0.50
draft	9.0	vmax =	0.00 tmax = 865.
speed	9.1 mph	vmin =	0.00 tmin = 865.
direction	downstream		
distance	310		

MARSH MCBIRNEY S11/S27 PLOTTING ROUTINE X - COMPONENT

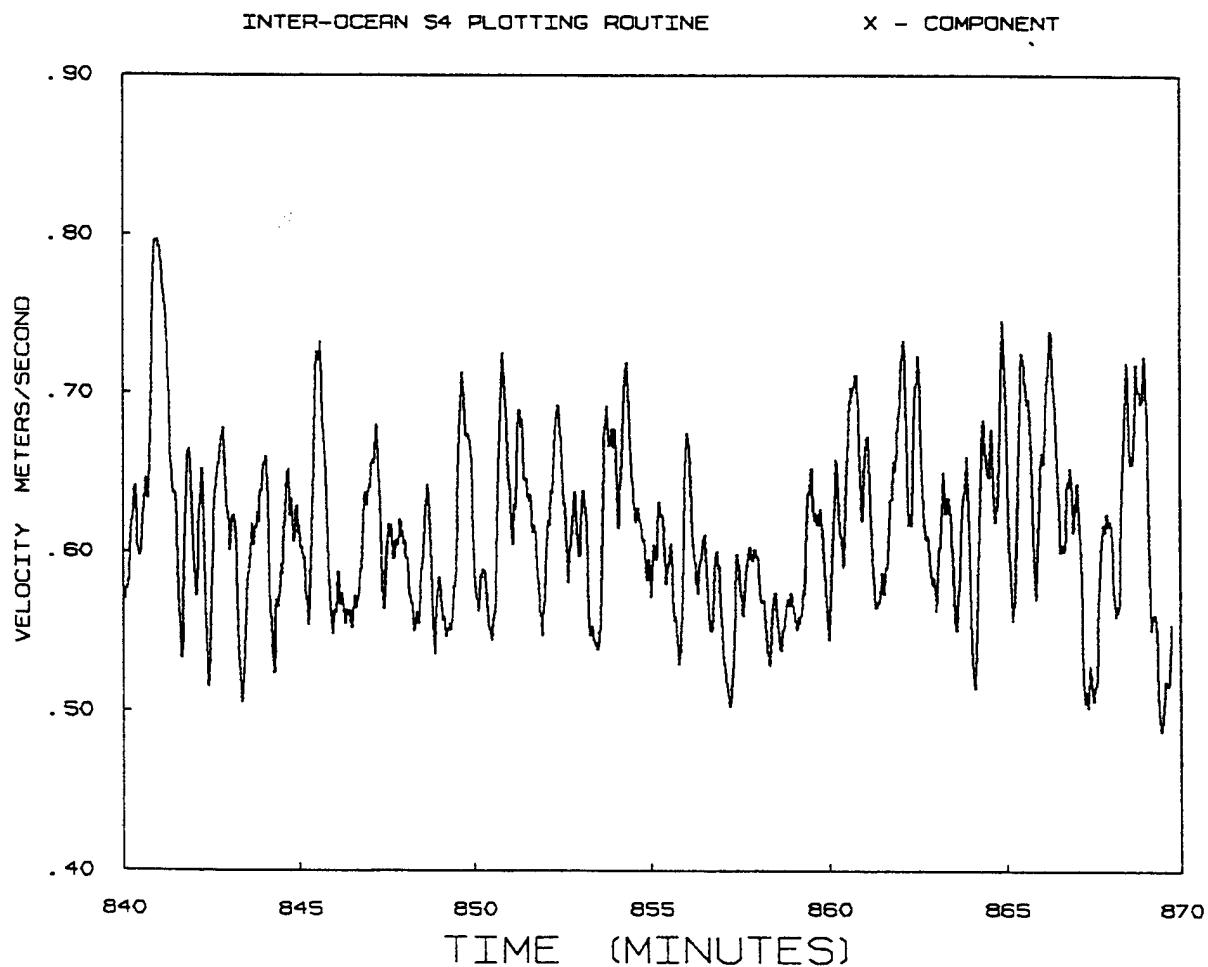


meter number	B-332	start-time	1400
tow name	james F.	end-time	1430
configuration	3x5	mean =	0.00
draft	9.0	vmax =	0.00 tmax = 863.
speed	9.1 mph	vmin =	0.00 tmin = 862.
direction	downstream		
distance	310		

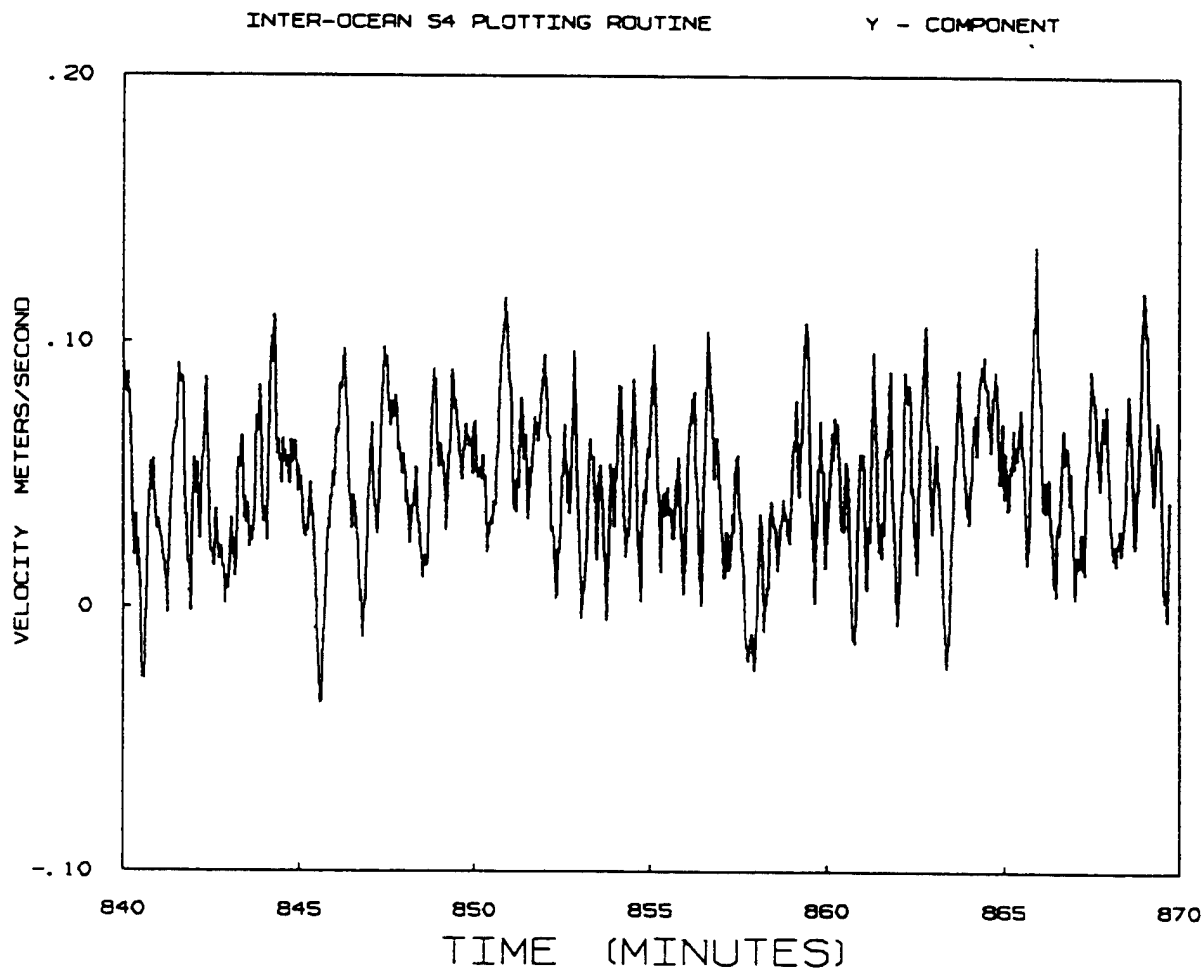
MARSH MCBIRNEY S11/527 PLOTTING ROUTINE Y - COMPONENT



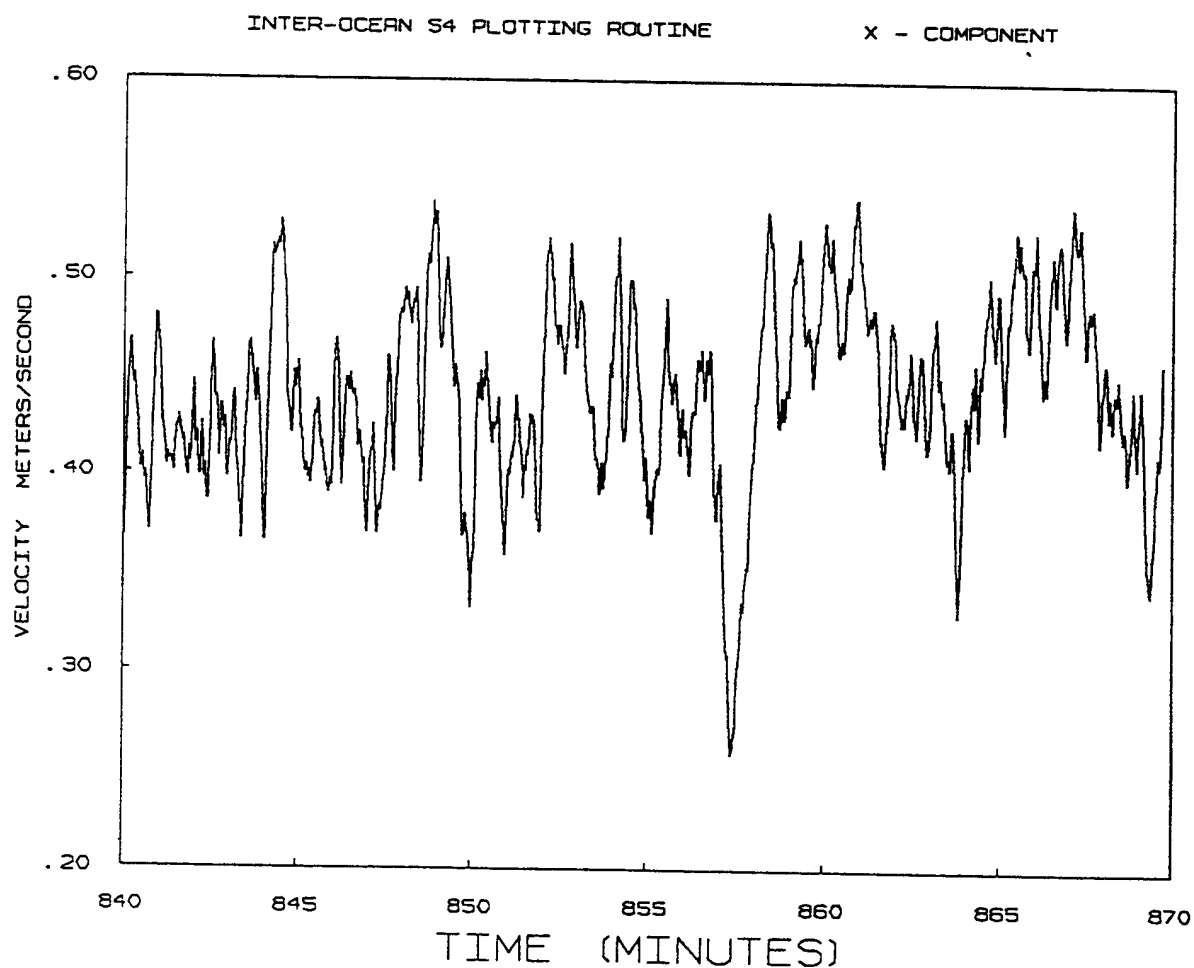
meter number	071	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	MEAN =	0.61
speed	9.1 mph	VMAX =	0.80 TMAX = 841.
direction	downstream	VMIN =	0.49 TMIN = 869.



meter number	071	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	MEAN =	0.04
speed	9.1 mph	VMAX =	0.14 TMAX = 866.
direction	downstream	VMIN =	-0.04 TMIN = 846.



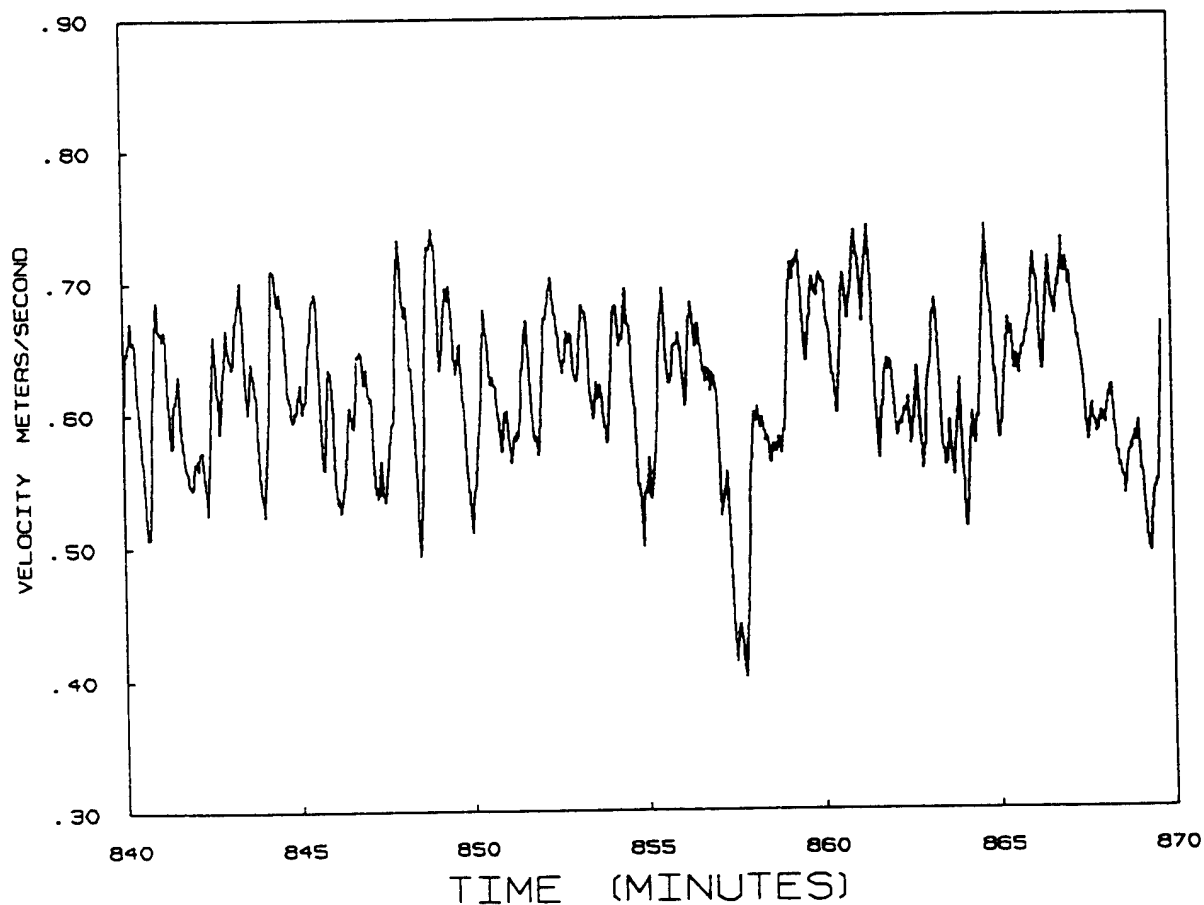
meter number	834	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	MEAN =	0.43
speed	9.1 mph	VMAX =	0.54 TMAX = 861.
direction	downstream	VMIN =	0.26 TMIN = 857.



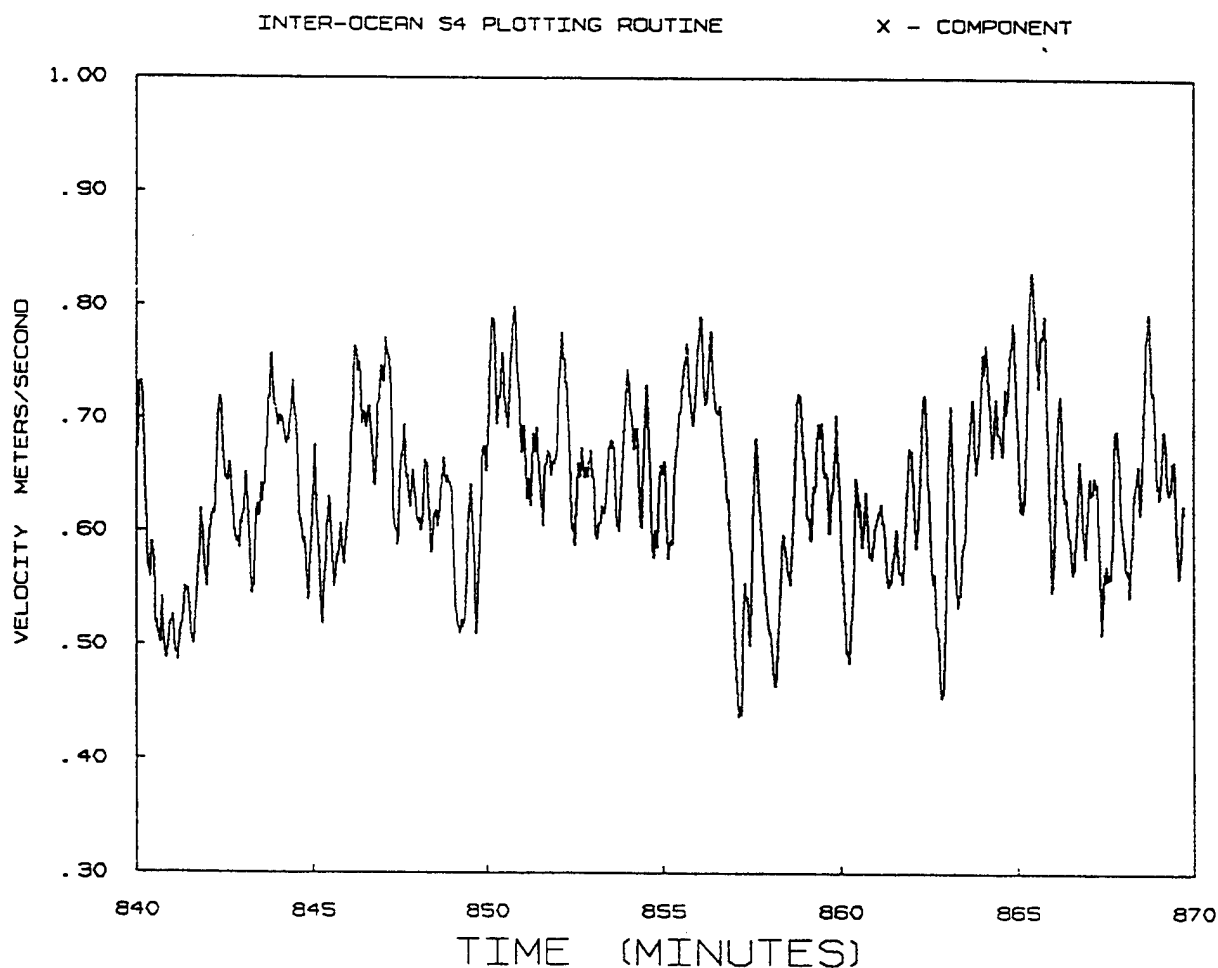
meter number	834	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	MEAN =	0.62
speed	9.1 mph	VMAX =	0.74 TMAX = 861.
direction	downstream	VMIN =	0.40 TMIN = 858.

INTER-OCEAN S4 PLOTTING ROUTINE

Y - COMPONENT



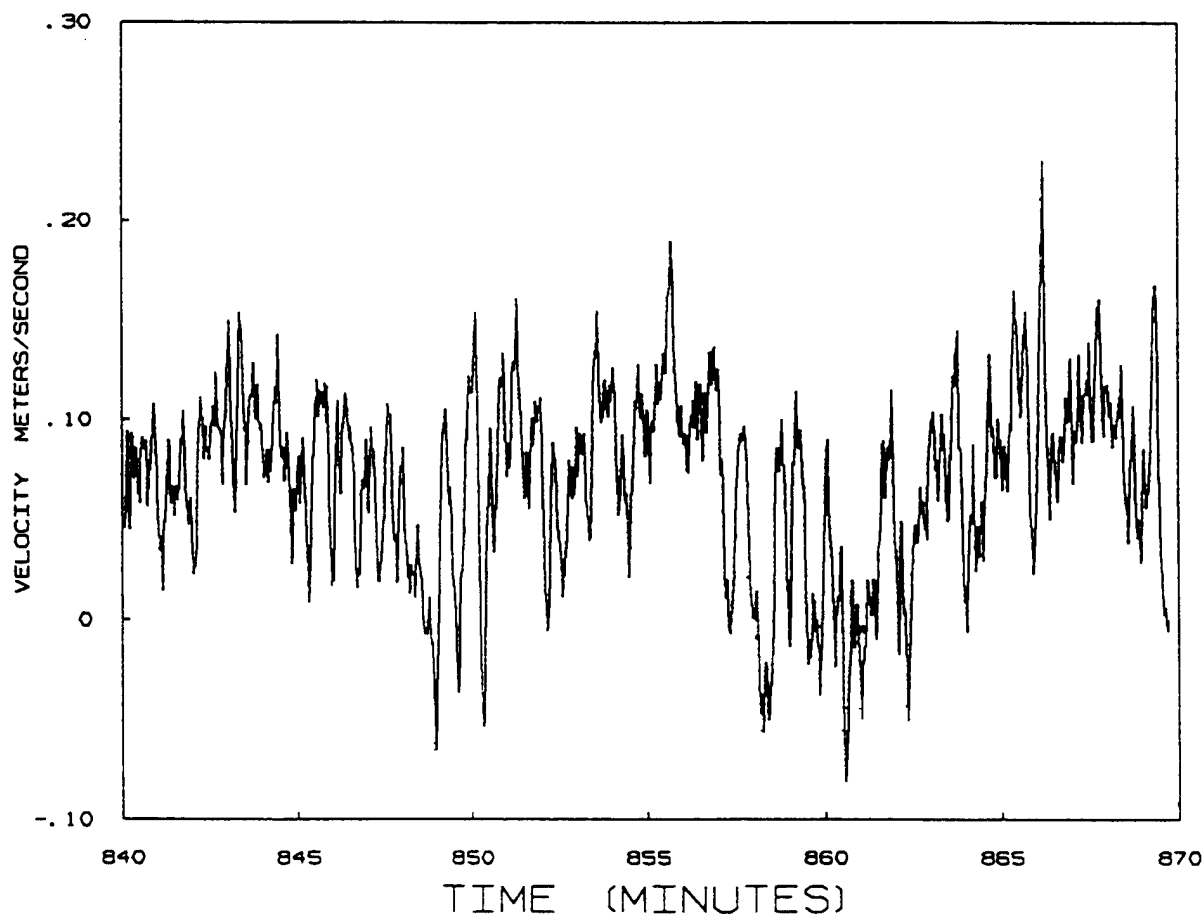
meter number	040	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	MEAN =	0.62
speed	9.1 mph	VMAX =	0.83 TMAX = 865.
direction	downstream	VMIN =	0.44 TMIN = 857.



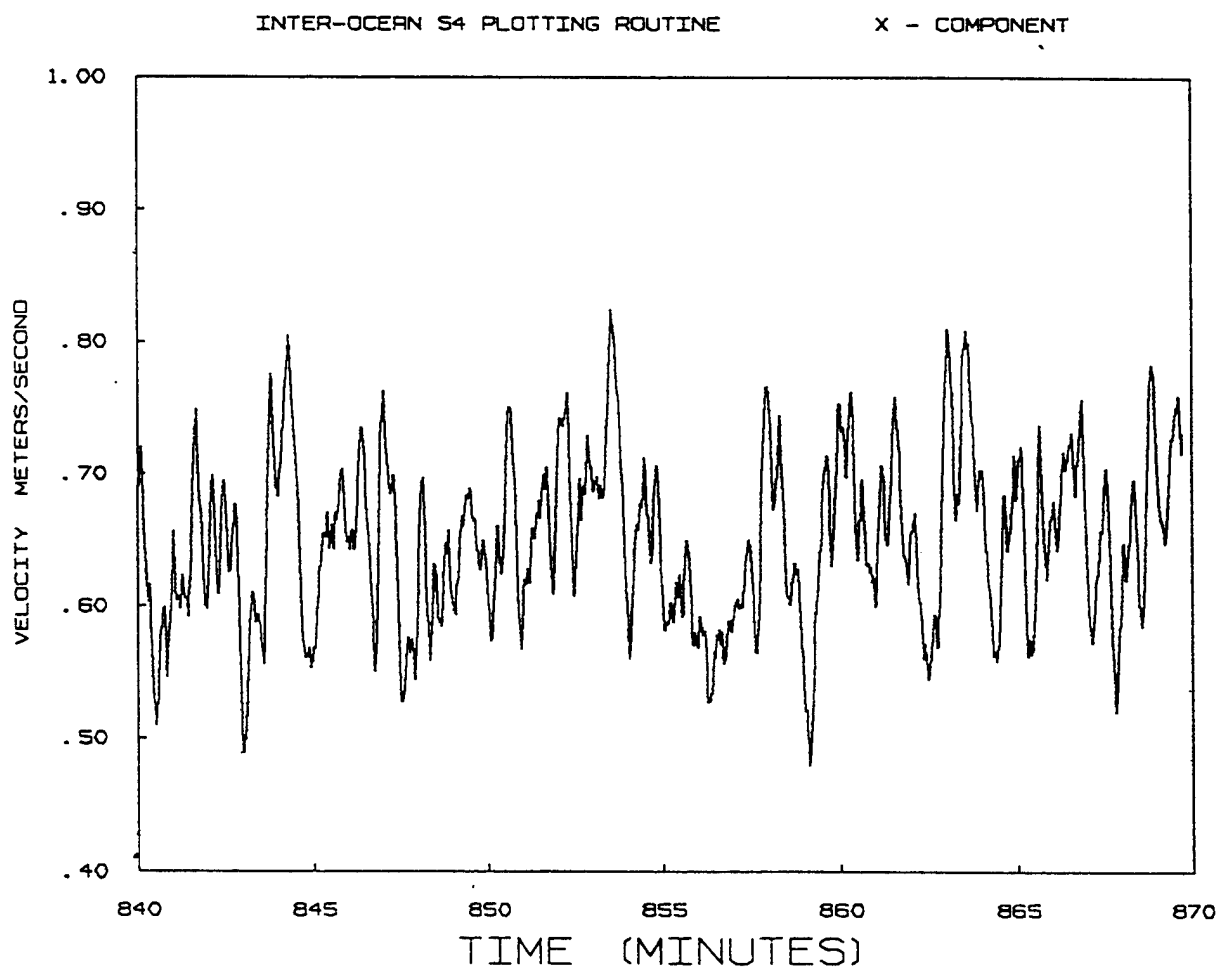
meter number	040	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	MEAN =	0.07
speed	9.1 mph	VMAX =	0.23 TMAX = 866.
direction	downstream	VMIN =	-0.08 TMIN = 861.

INTER-OCEAN S4 PLOTTING ROUTINE

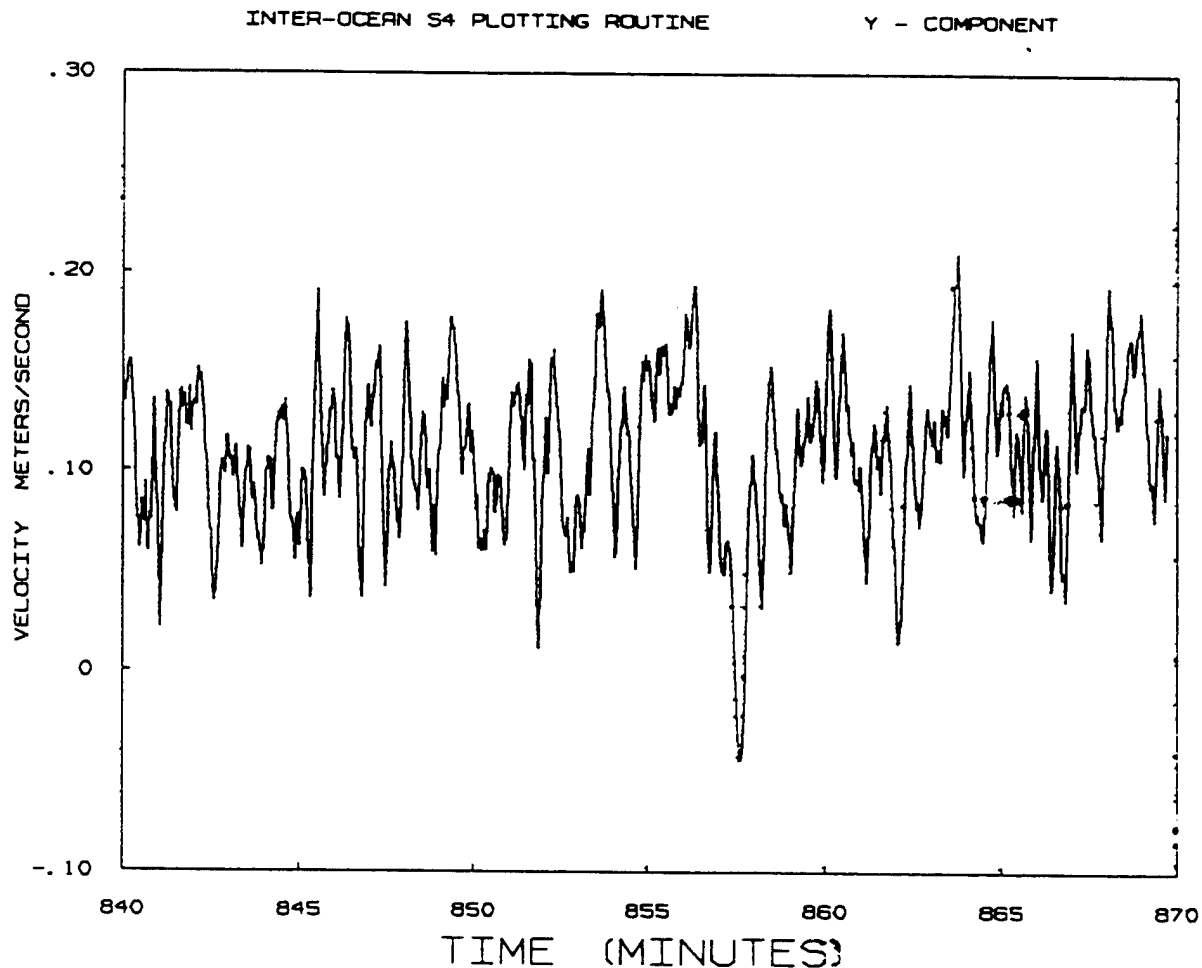
Y - COMPONENT



meter number	151	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	MEAN =	0.64
speed	9.1 mph	VMAX =	0.82 TMAX = 854.
direction	downstream	VMIN =	0.48 TMIN = 859.



meter number	151	distance	310
tow name	james F.	start-time	1400
configuration	3x5	end-time	1430
draft	9.0	MEAN =	0.11
speed	9.1 mph	VMAX =	0.21 TMAX = 864.
direction	downstream	VMIN =	-0.04 TMIN = 858.



XX-7. Velocity fluctuations measured by two-dimensional current meters
for barge *Irving Crown* at Kampsville, trip 2

Irving Crown (8/14/91)

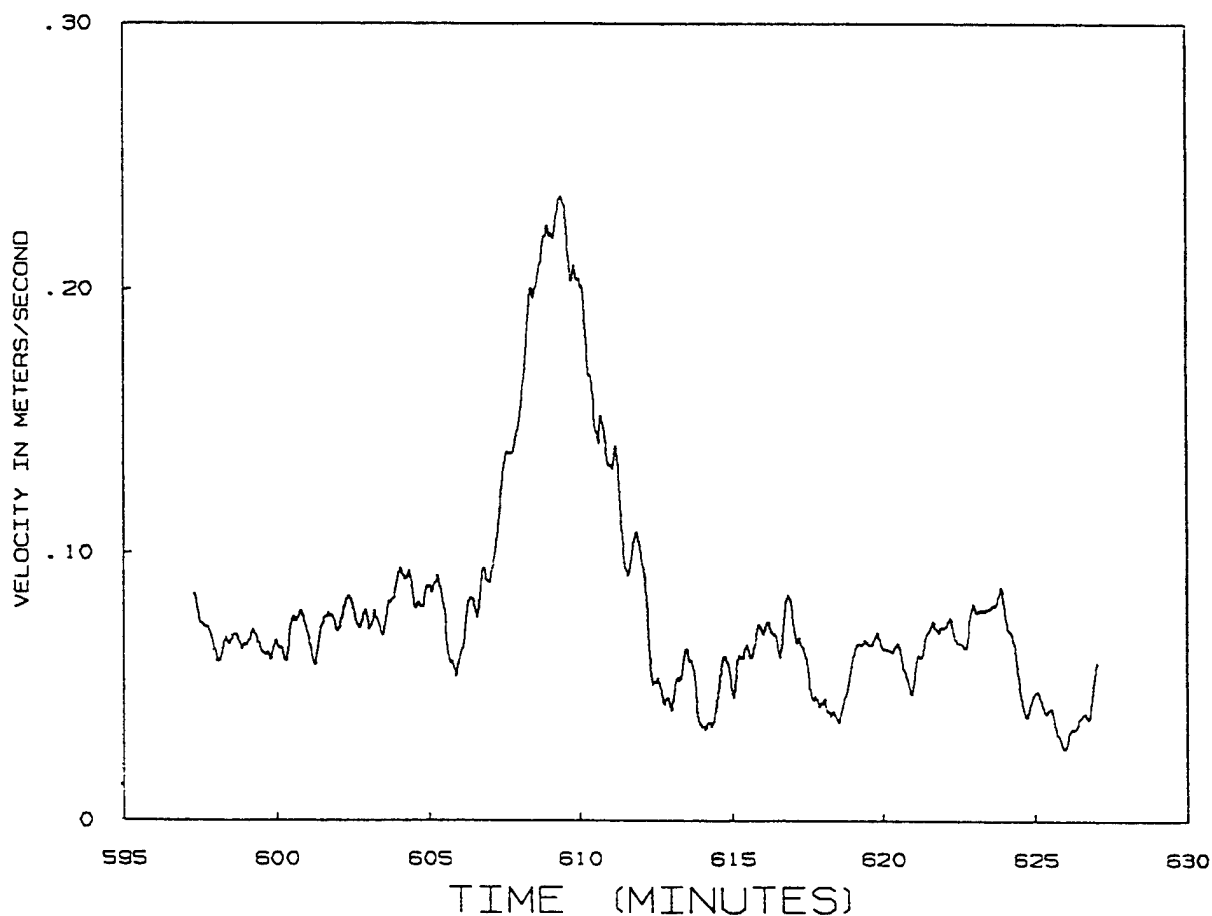
Status of Electromagnetic Current Meters:

1001 (MMB511) ✓	998 (MMB511) ✓	999 (MMB511) ✓	1000 (MMB511) *
332 (MMB527) ✓	642 (MMB527) ✓		

Note: ✓ : Working
* : Not working

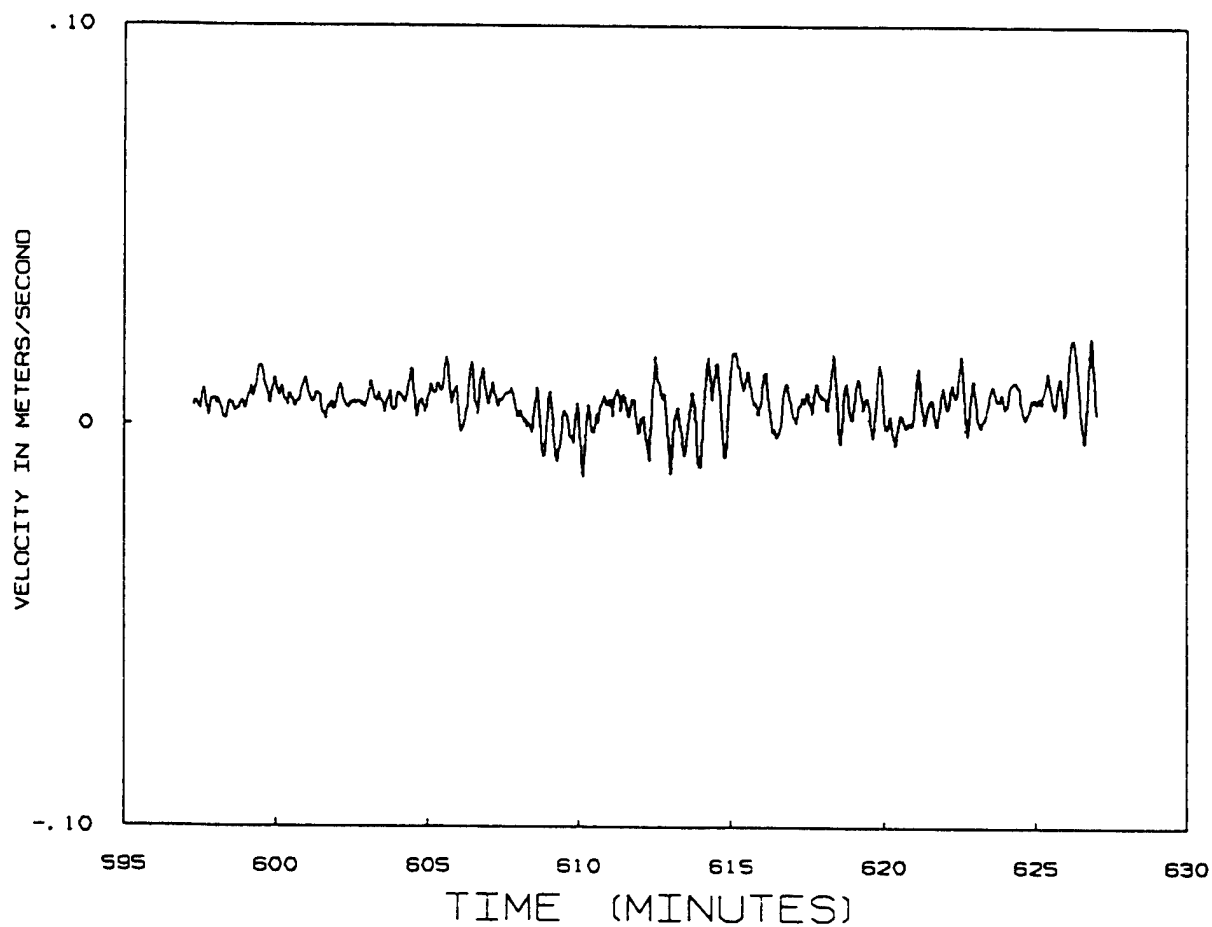
meter number	511-1001	start-time	0955
tow name	Icrown	end-time	1025
configuration	2x2 + 3	mean =	0.07
draft	9.0	vmax =	0.00 tmax = 609.
speed	3.6 mph	vmin =	0.00 tmin = 626.
direction	upstream		
distance	722		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



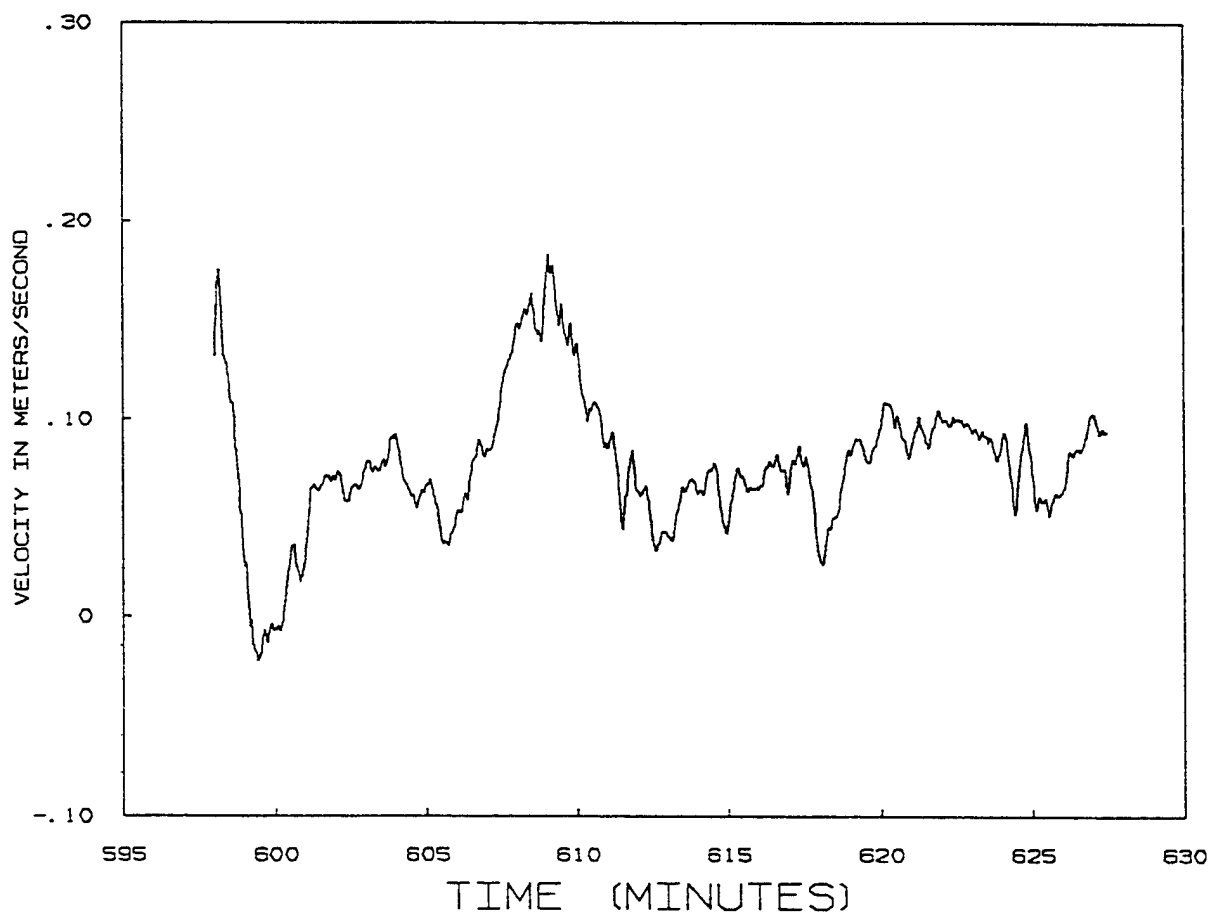
meter number	511-1001	start-time	0955
tow name	lcrown	end-time	1025
configuration	2x2 + 3	mean =	0.01
draft	9.0	vmax =	0.00 tmax = 627.
speed	3.6 mph	vmin =	0.00 tmin = 610.
direction	upstream		
distance	722		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



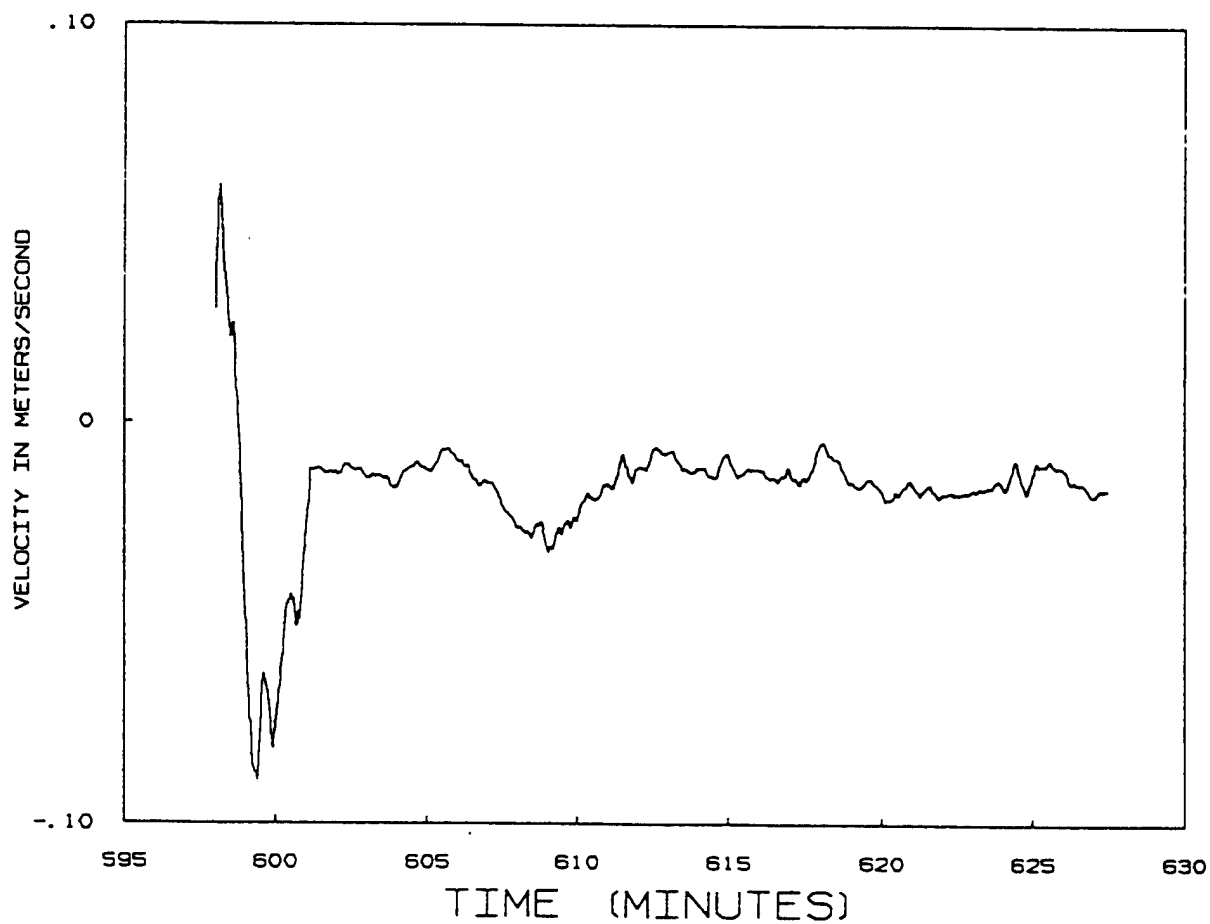
meter number	998	distance	722
tow name	Icrown	start-time	0958
configuration	2x2 + 3	end-time	1028
draft	9.0	mean =	0.06
speed	3.6 mph	vmax =	0.18 tmax = 609.
direction	upstream	vmin =	-0.02 tmin = 599.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



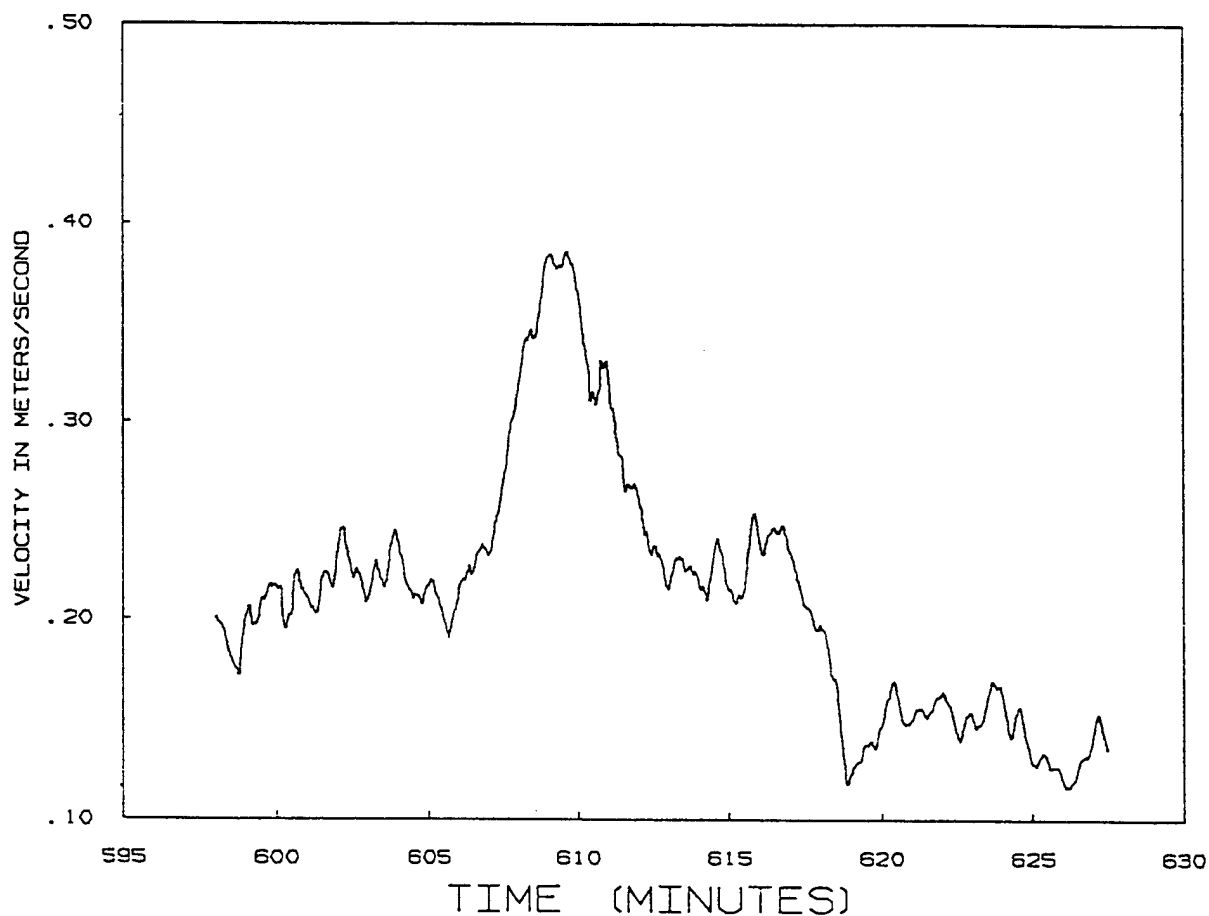
meter number	998	distance	722
tow name	Icrown	start-time	0958
configuration	2x2 + 3	end-time	1028
draft	9.0	mean	= -0.02
speed	3.6 mph	vmax	= 0.06 tmax = 598.
direction	upstream	vmin	= -0.09 tmin = 599.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



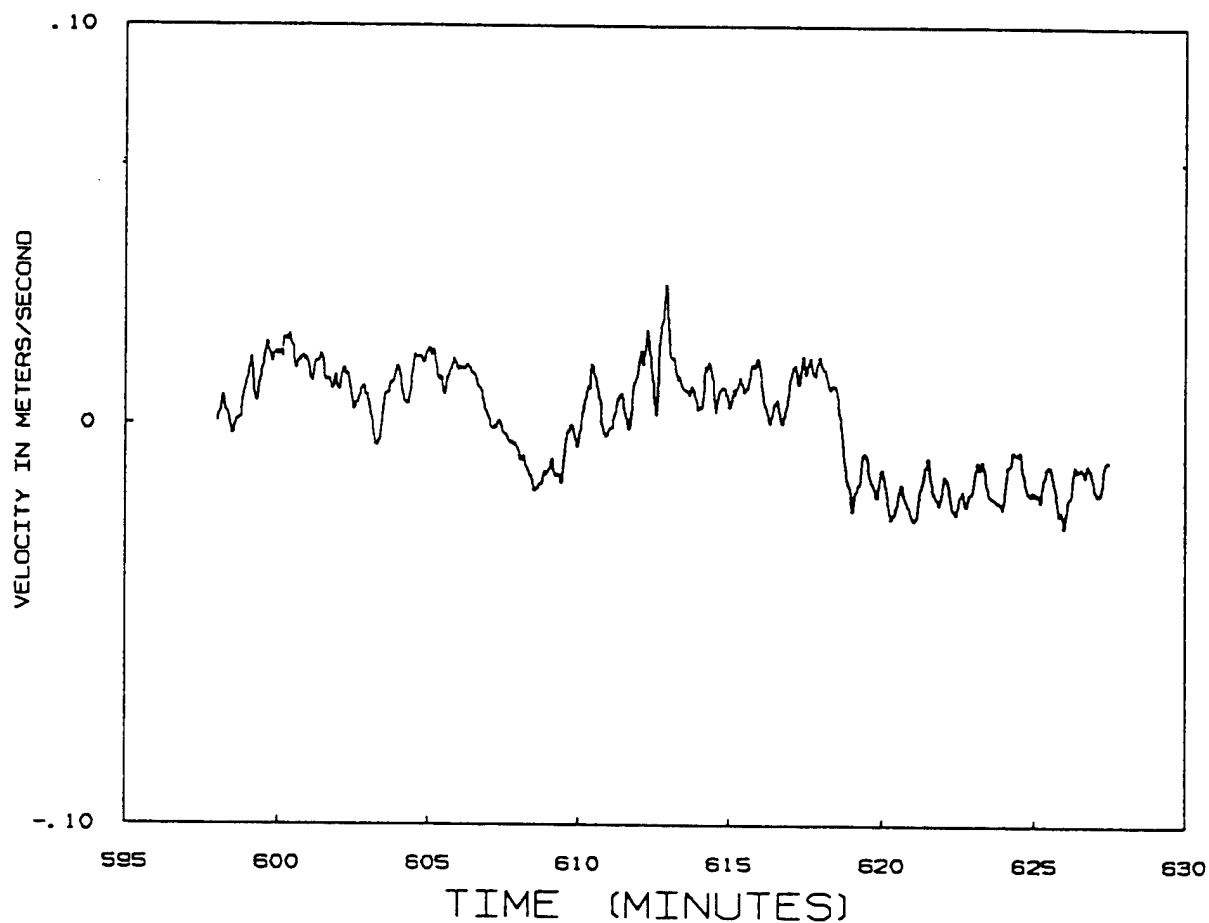
meter number	999	distance	722
tow name	lcrown	start-time	0958
configuration	2x2 + 3	end-time	1028
draft	9.0	mean =	0.22
speed	3.6 mph	vmax =	0.39 tmax = 610.
direction	upstream	vmin =	0.12 tmin = 626.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



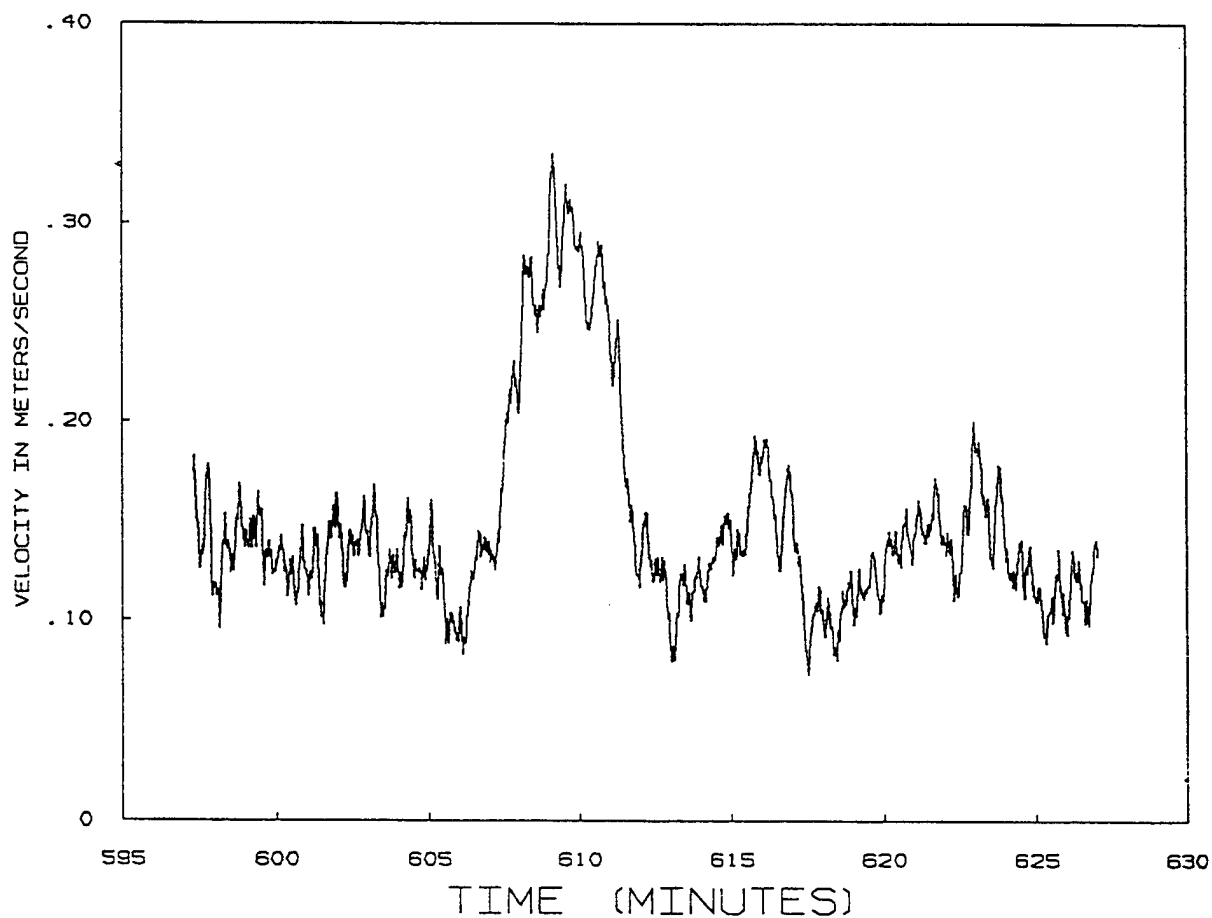
meter number	999	distance	722
tow name	lcrown	start-time	0958
configuration	2x2 + 3	end-time	1028
draft	9.0	mean =	0.01
speed	3.6 mph	vmax =	0.04 tmax = 613.
direction	upstream	vmin =	-0.03 tmin = 626.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



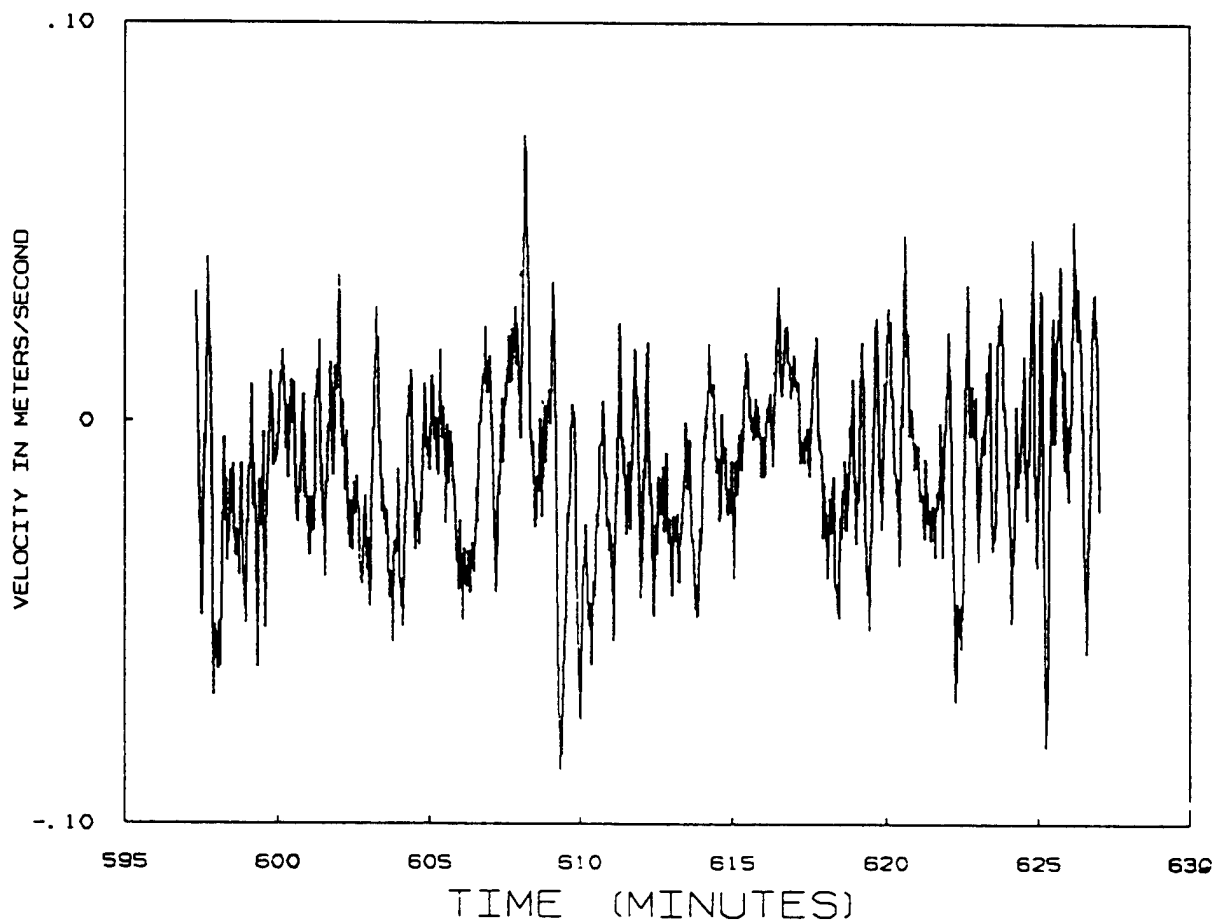
meter number	B-642	start-time	0955
tow name	Icrown	end-time	1025
configuration	2x2 + 3	mean =	0.13
draft	9.0	vmax =	0.00 tmax = 609.
speed	3.6 mph	vmin =	0.00 tmin = 618.
direction	upstream		
distance	722		

MARSH MCBIRNEY S11/527 PLOTTING ROUTINE X - COMPONENT



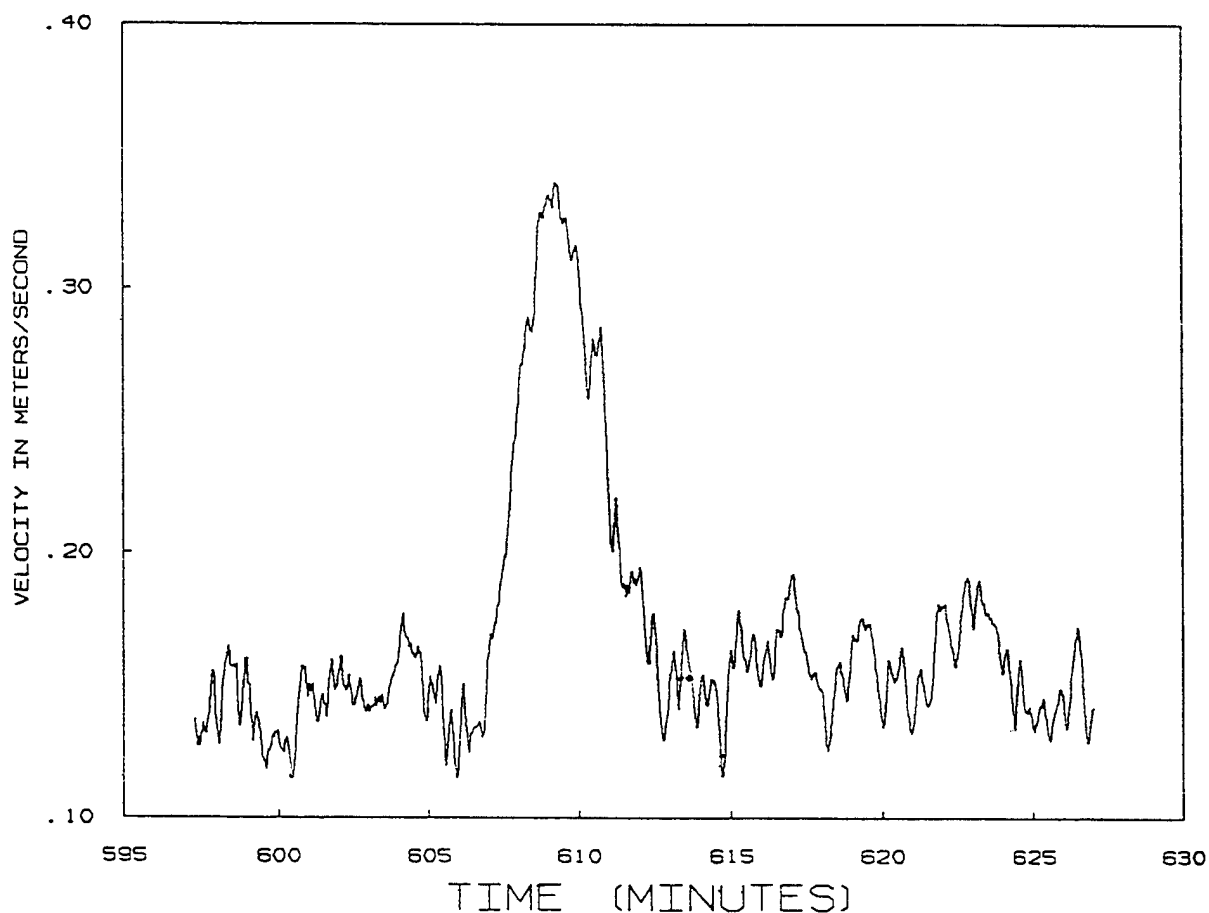
meter number	B-642	start-time	0955
tow name	Icrown	end-time	1025
configuration	2x2 + 3	mean =	-0.02
draft	9.0	vmax =	0.00 tmax = 608.
speed	3.6 mph	vmin =	0.00 tmin = 609.
direction	upstream		
distance	722		

MARSH MCBIRNEY S11/S27 PLOTTING ROUTINE Y - COMPONENT



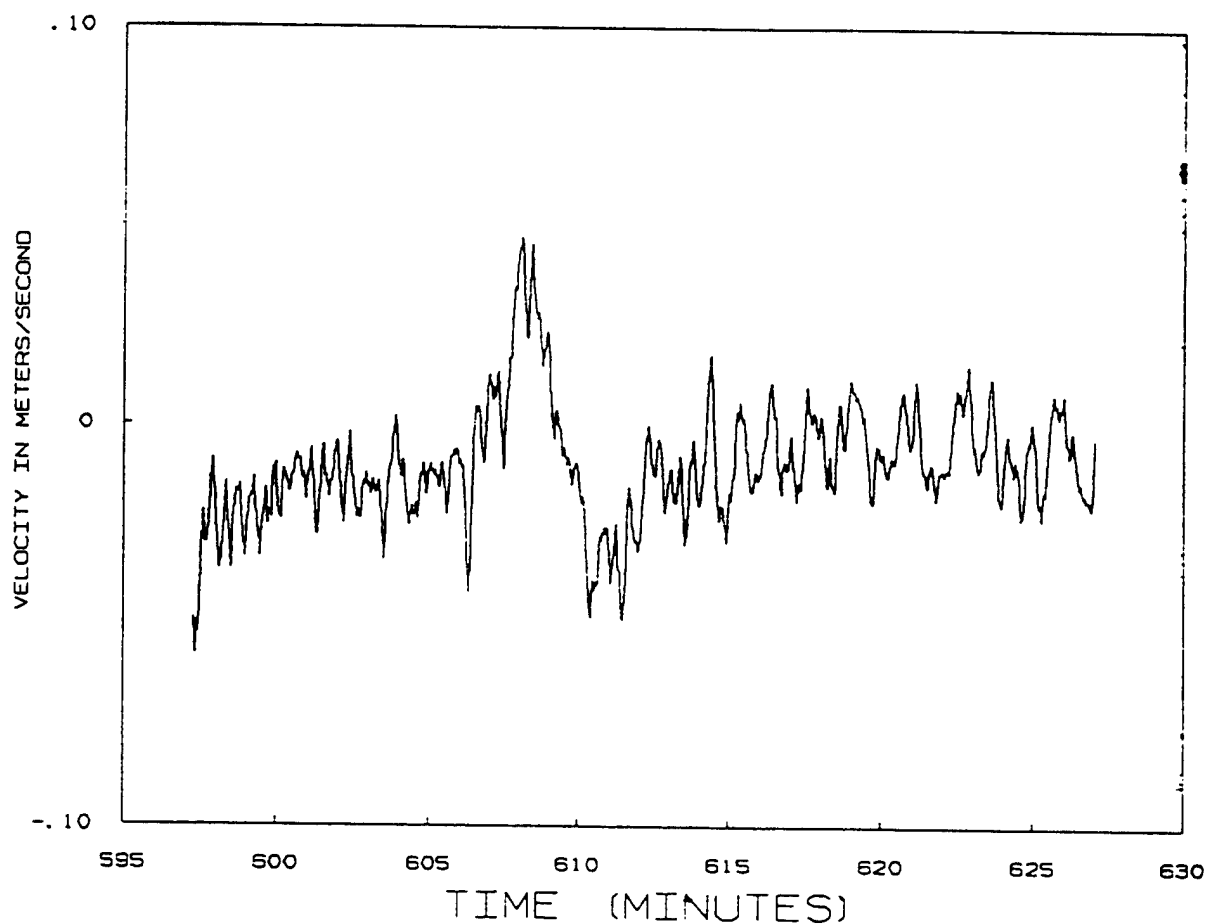
meter number	B-332	start-time	0955
tow name	lcrown	end-time	1025
configuration	2x2 + 3	mean =	0.14
draft	9.0	vmax =	0.00 tmax = 609.
speed	3.6 mph	vmin =	0.00 tmin = 600.
direction	upstream		
distance	722		

MARSH MCBIRNEY S11/S27 PLOTTING ROUTINE X - COMPONENT



meter number	B-332	start-time	0955
tow name	lcrown	end-time	1025
configuration	2x2 + 3	mean =	-0.02
draft	9.0	vmax =	0.00 tmax = 608.
speed	3.6 mph	vmin =	0.00 tmin = 597.
direction	upstream		
distance	722		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



XX-8. Velocity fluctuations measured by two-dimensional current meters
for barge *Jack Bullard* at Clarks Ferry, trip 2

Jack Bullard (10/19/91)

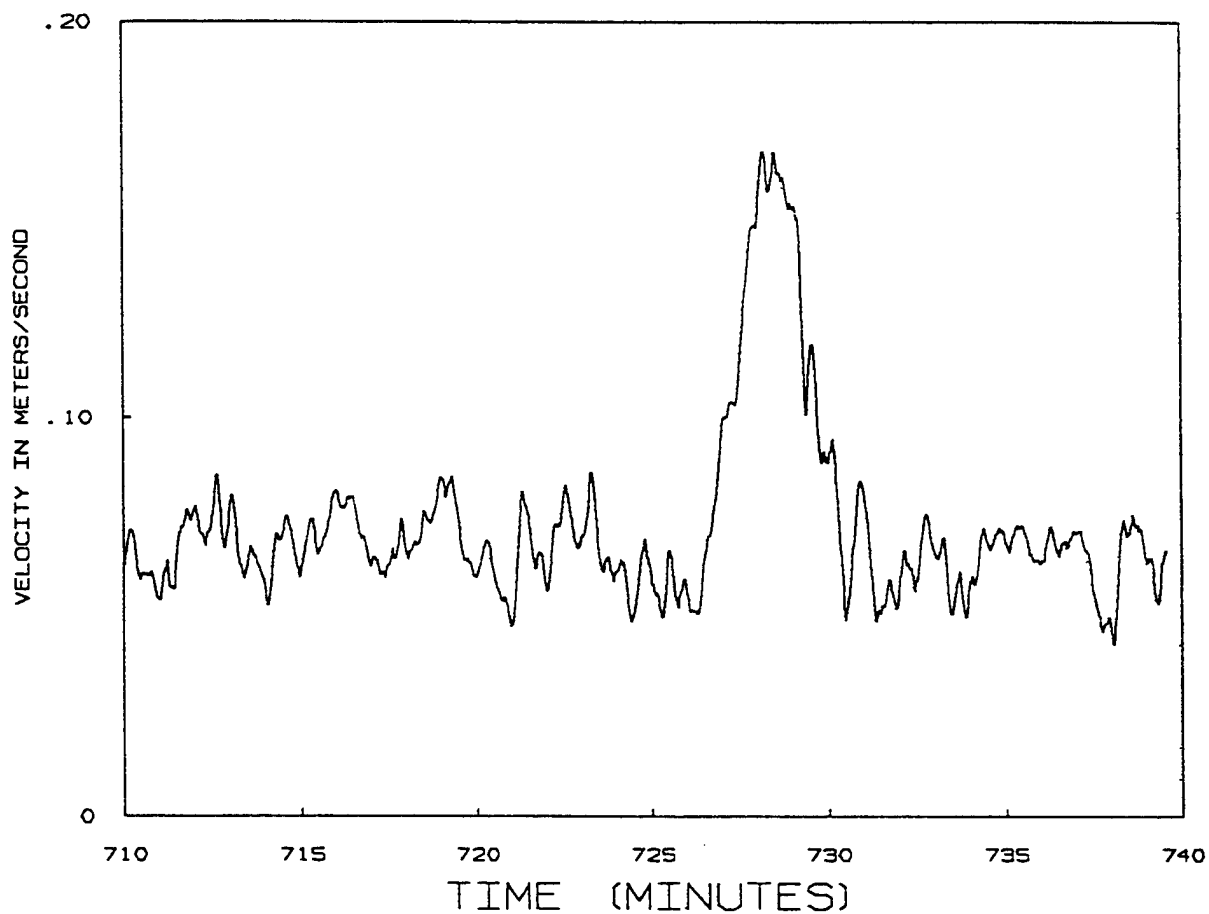
Status of Electromagnetic Current Meters:

1001 (MMB511) ✓	998 (MMB511) ✓	999 (MMB511) ✓	1000 (MMB511) ✓	1330 (MMB511) ✓	1331 (MMB511) ✓
834 (S4) ✓	151 (S4) ✓	832 (S4) *	040 (S4) ✓		
332 (MMB527) ✓	642 (MMB527) ✓				

Note: ✓ : Working
* : Not working
- : Not available

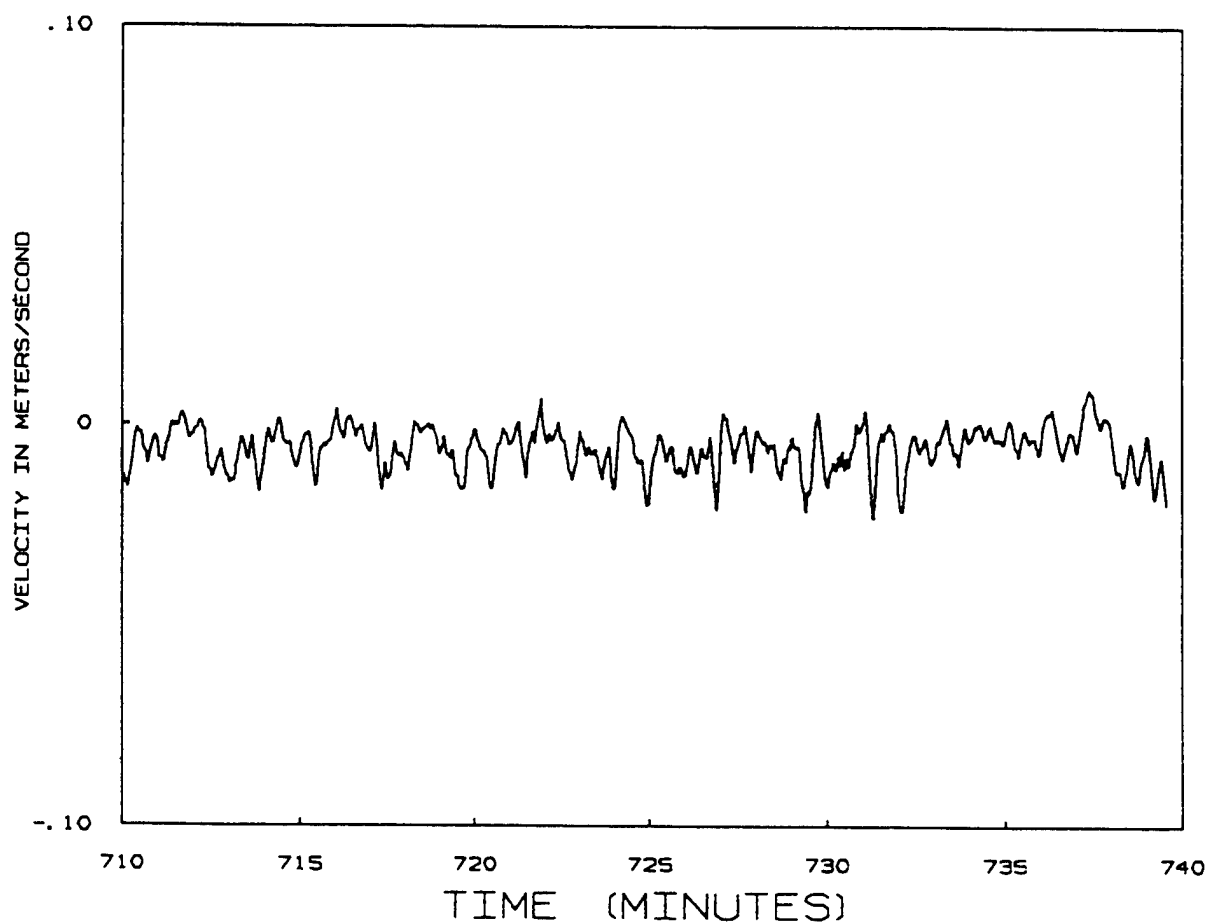
meter number	1001	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.07
speed	5.3 mph	vmax =	0.17 tmax = 728.
direction	upstream	vmin =	0.04 tmin = 738.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



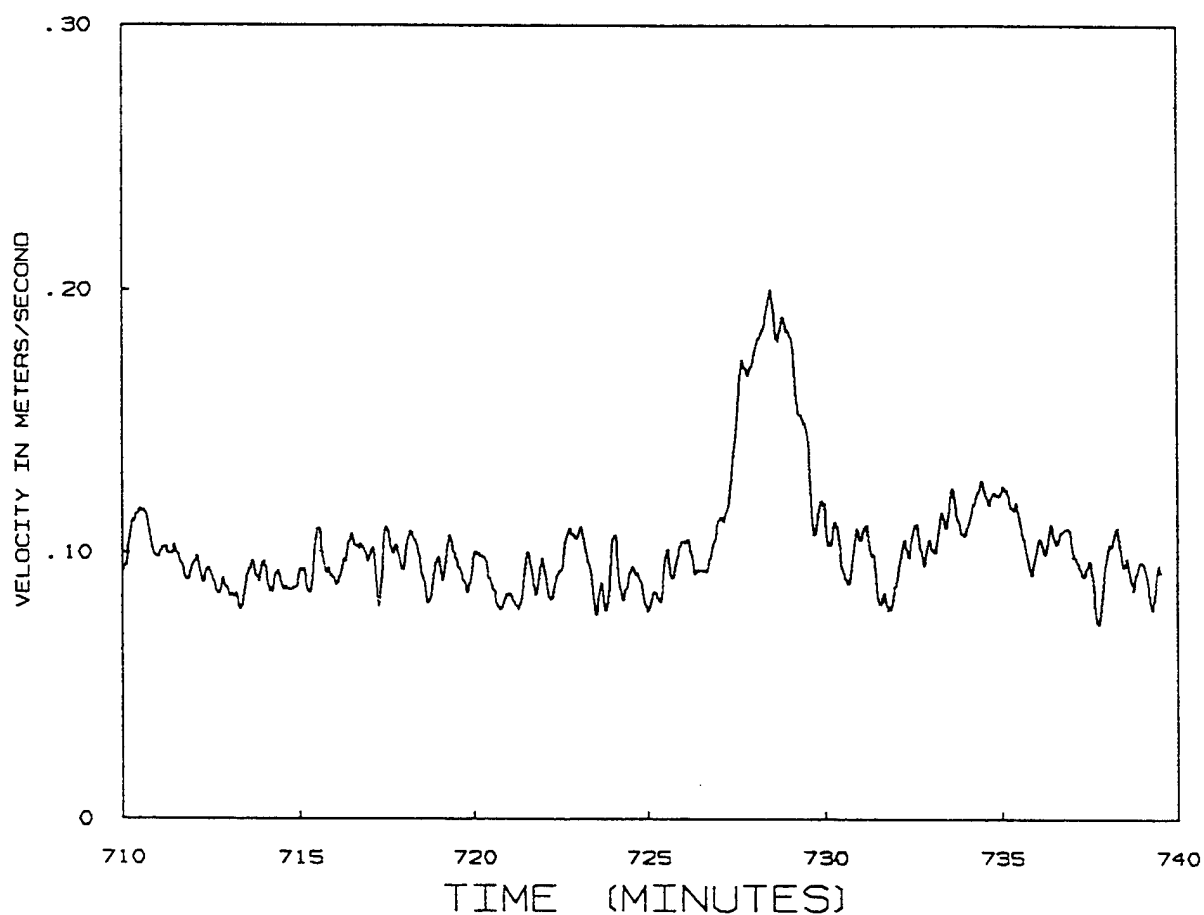
meter number	1001	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	-0.01
speed	5.3 mph	vmax =	0.01 tmax = 737.
direction	upstream	vmin =	-0.02 tmin = 731.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



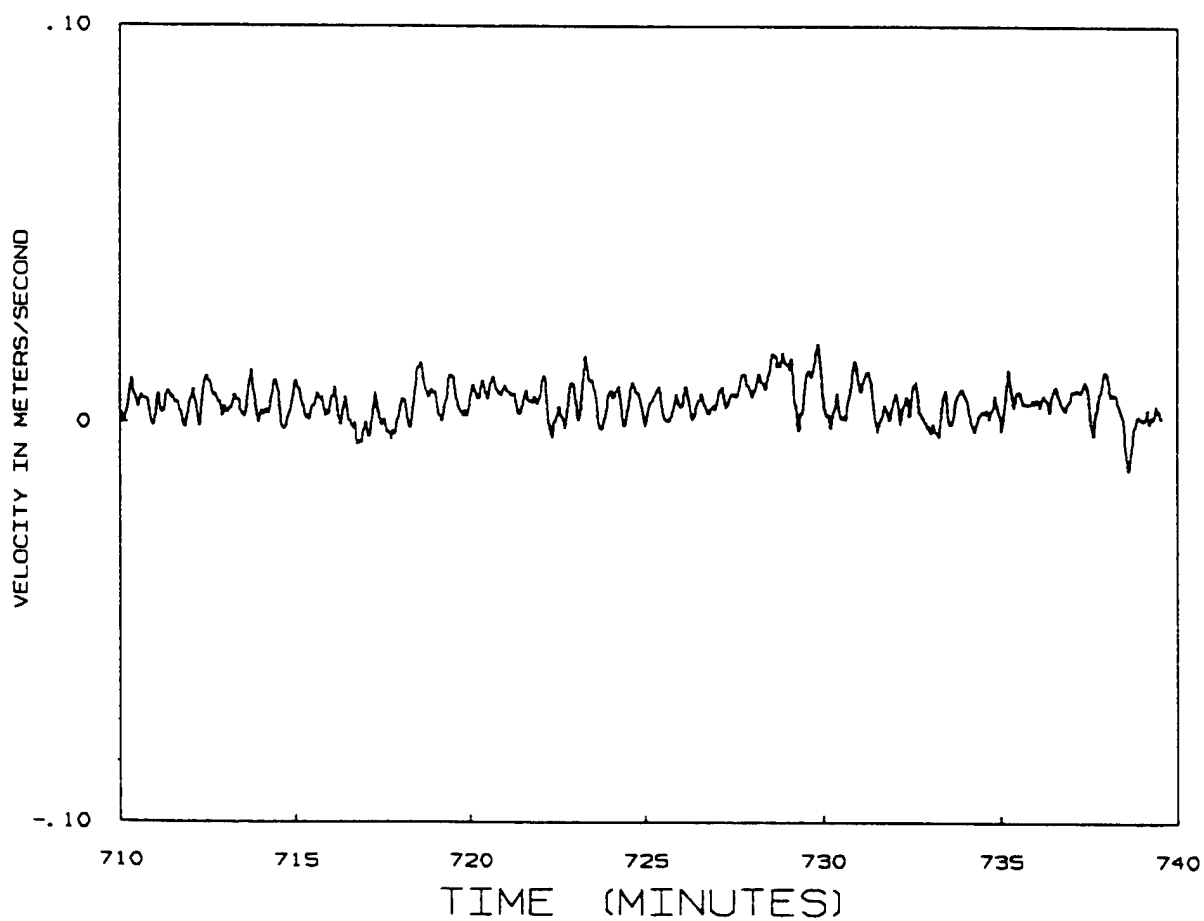
meter number	998	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.10
speed	5.3 mph	vmax =	0.20 tmax = 729.
direction	upstream	vmin =	0.07 tmin = 738.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



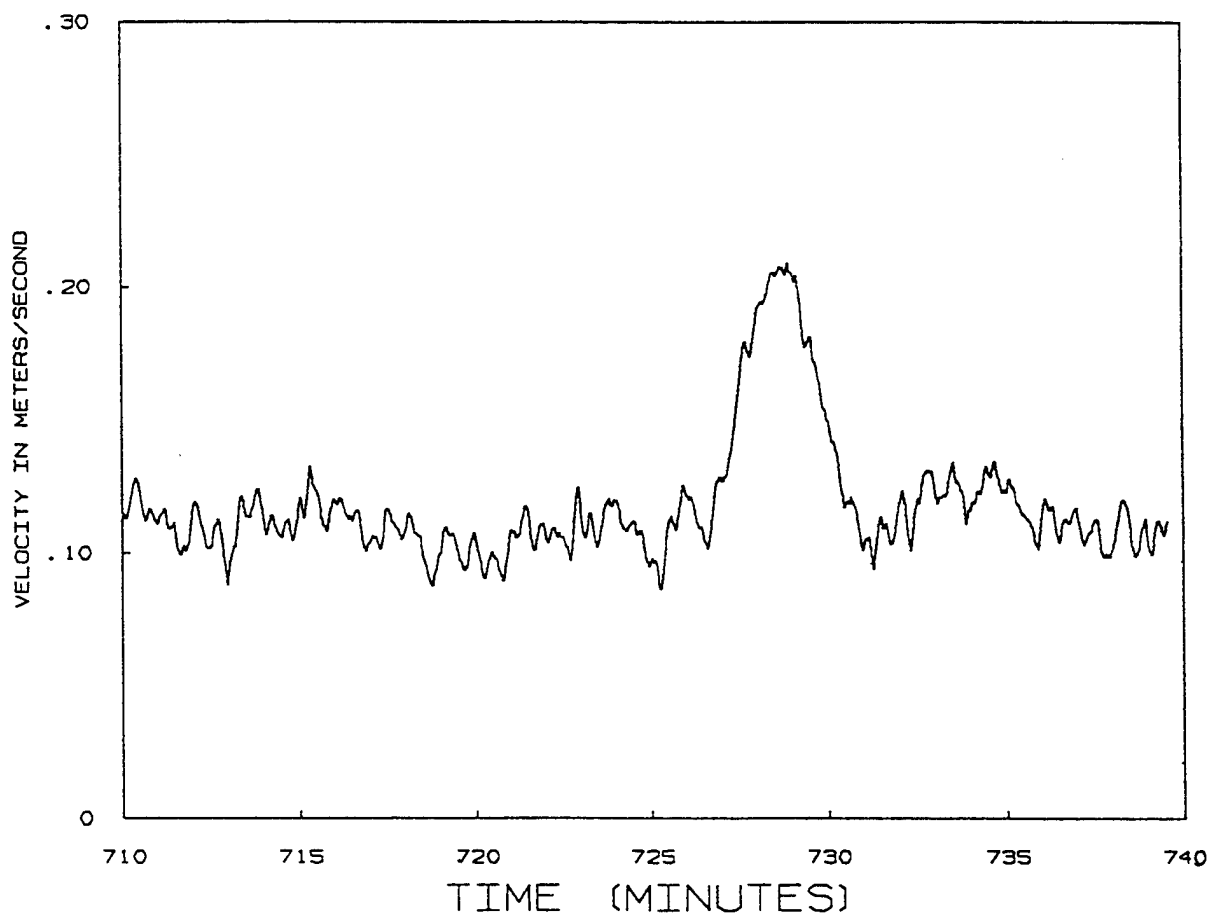
meter number	998	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.00
speed	5.3 mph	vmax =	0.02 tmax = 730.
direction	upstream	vmin =	-0.01 tmin = 739.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



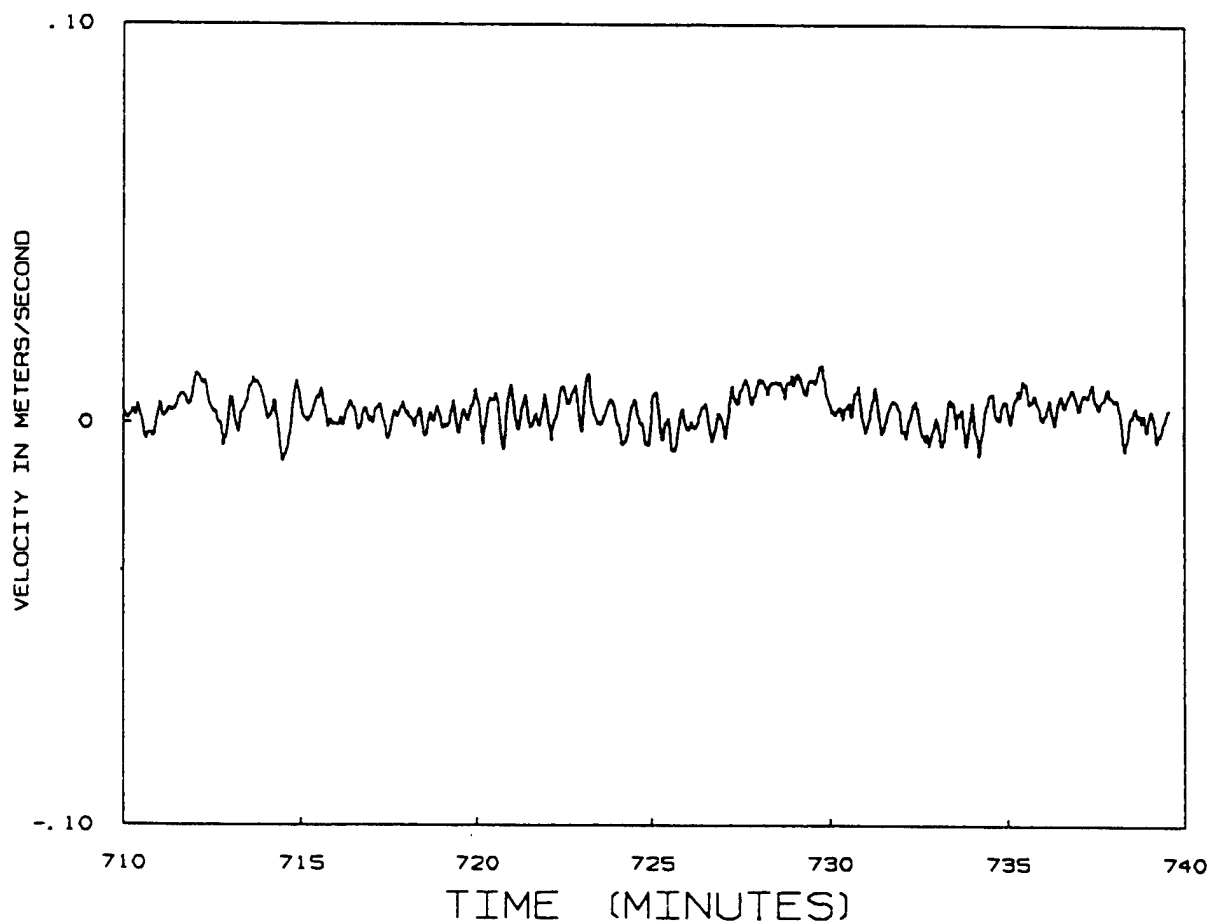
meter number	999	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.11
speed	5.3 mph	vmax =	0.21 tmax = 729.
direction	upstream	vmin =	0.09 tmin = 725.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



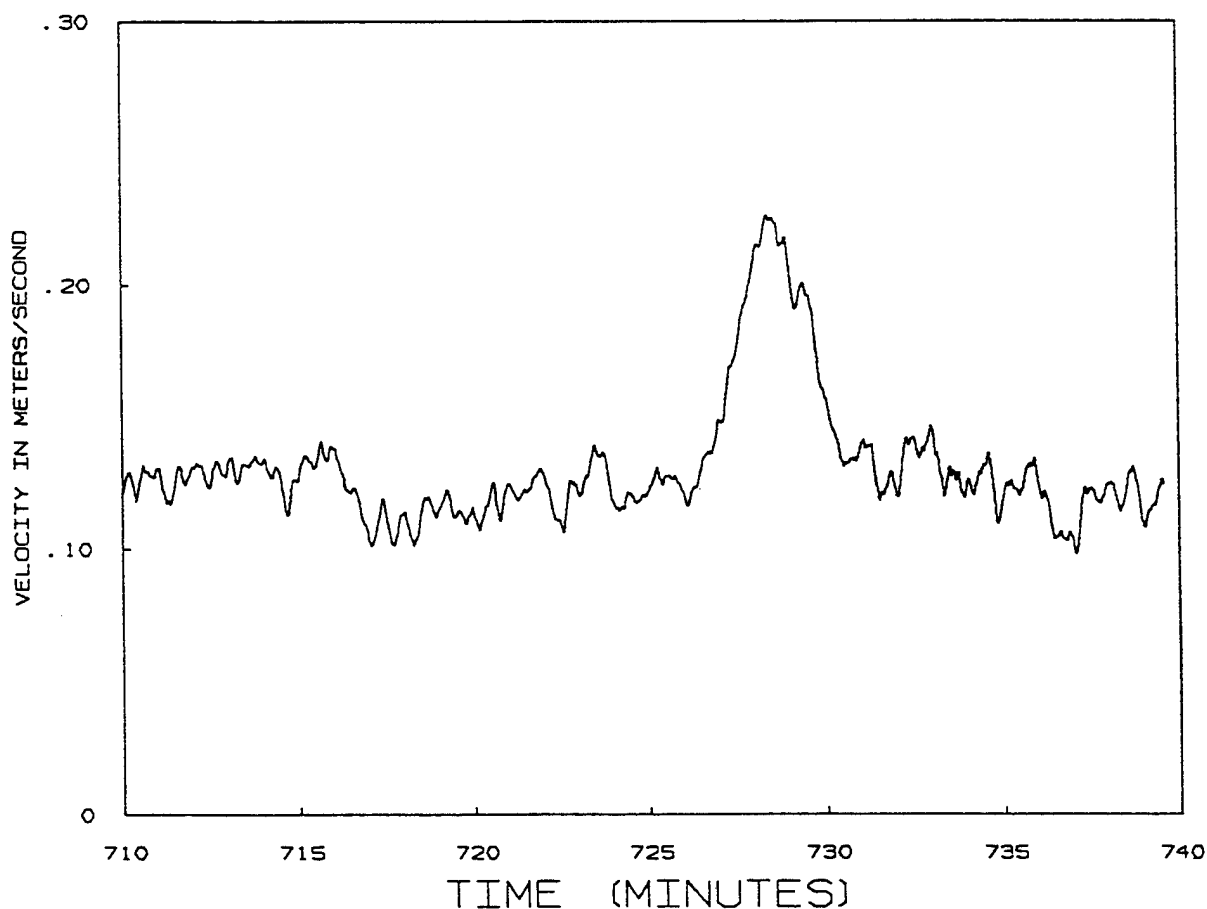
meter number	999	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.00
speed	5.3 mph	vmax =	0.01 tmax = 730.
direction	upstream	vmin =	-0.01 tmin = 714.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT Y - COMPONENT



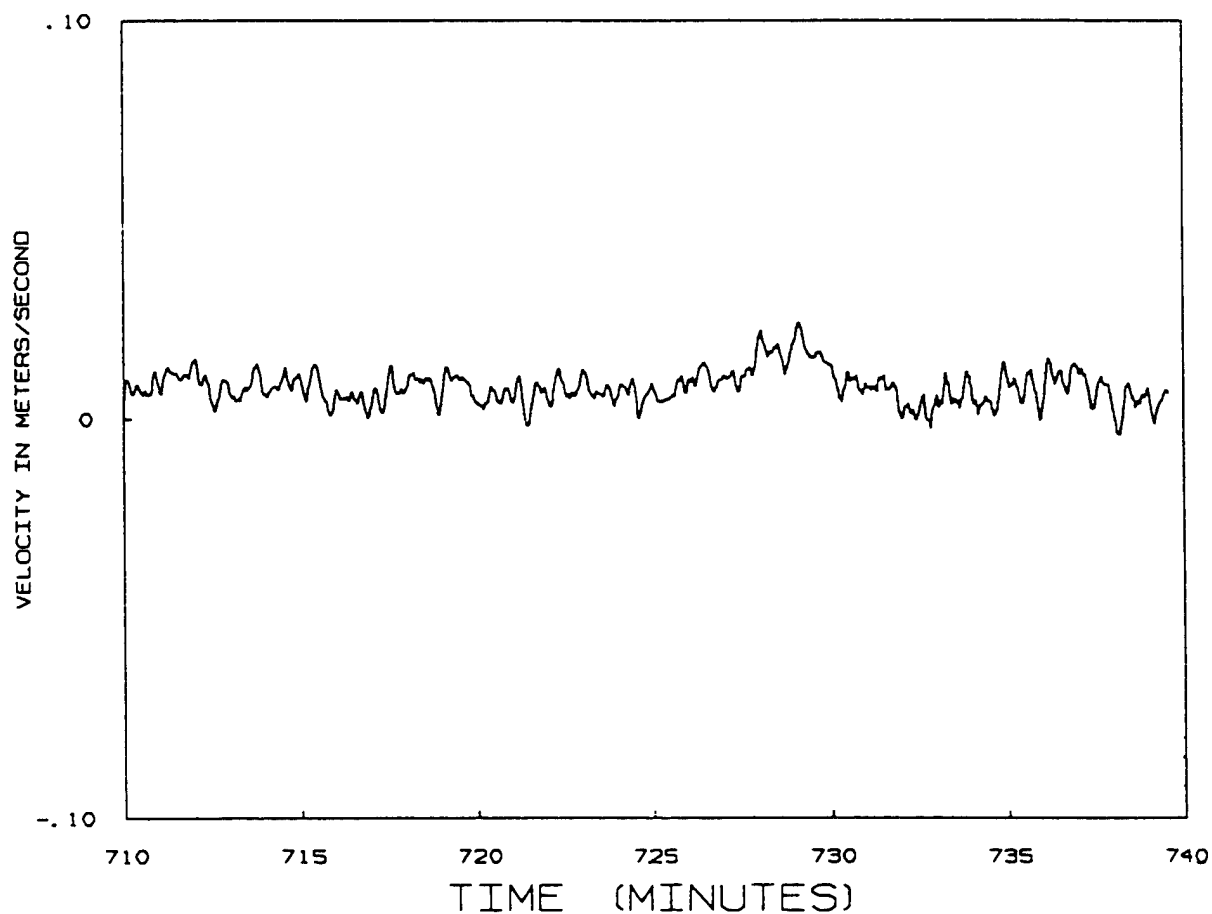
meter number	1000	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.12
speed	5.3 mph	vmax =	0.23 tmax = 728.
direction	upstream	vmin =	0.10 tmin = 737.

MARSH MCBIRNEY 511/LOGGER2 PLOTTING ROUT X - COMPONENT



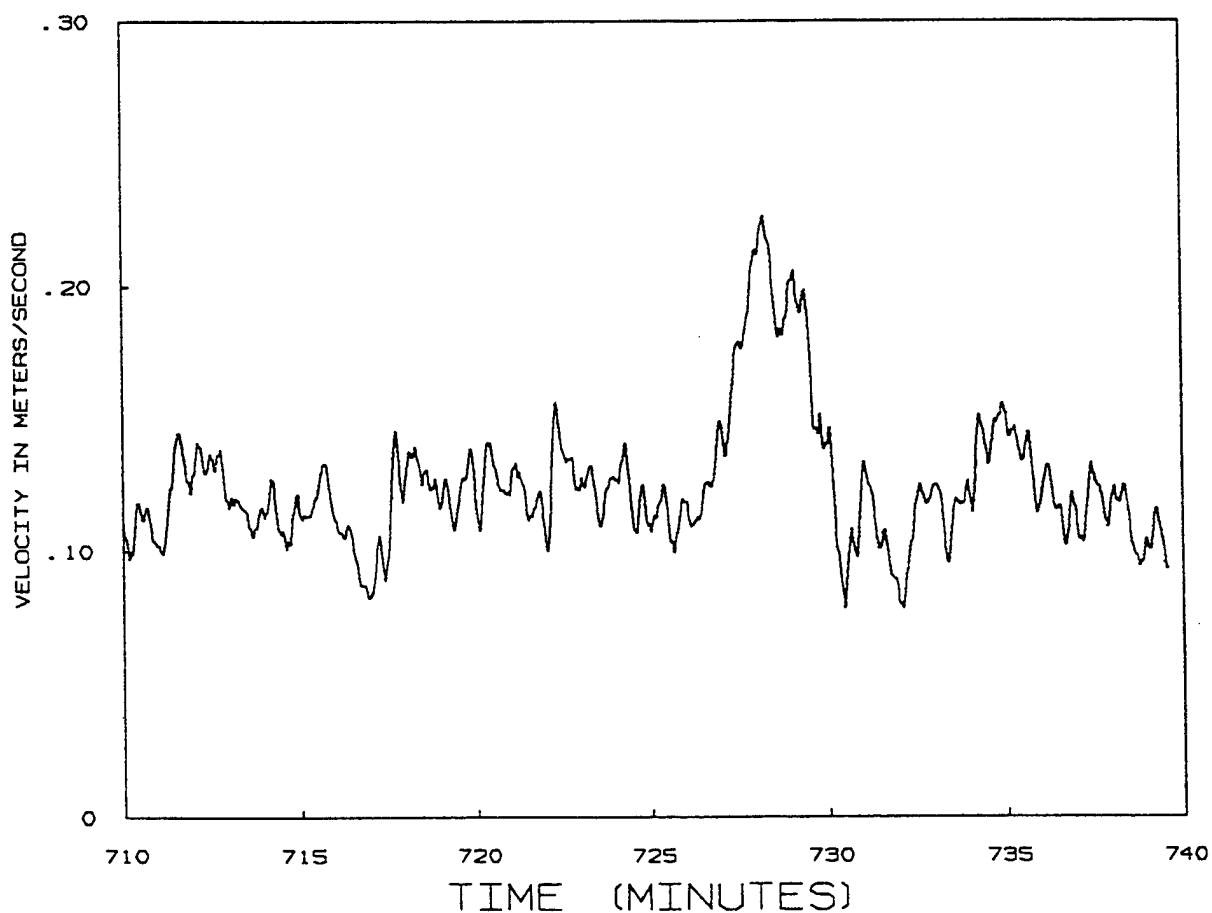
meter number	1000	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.01
speed	5.3 mph	vmax =	0.02 tmax = 729.
direction	upstream	vmin =	0.00 tmin = 738.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



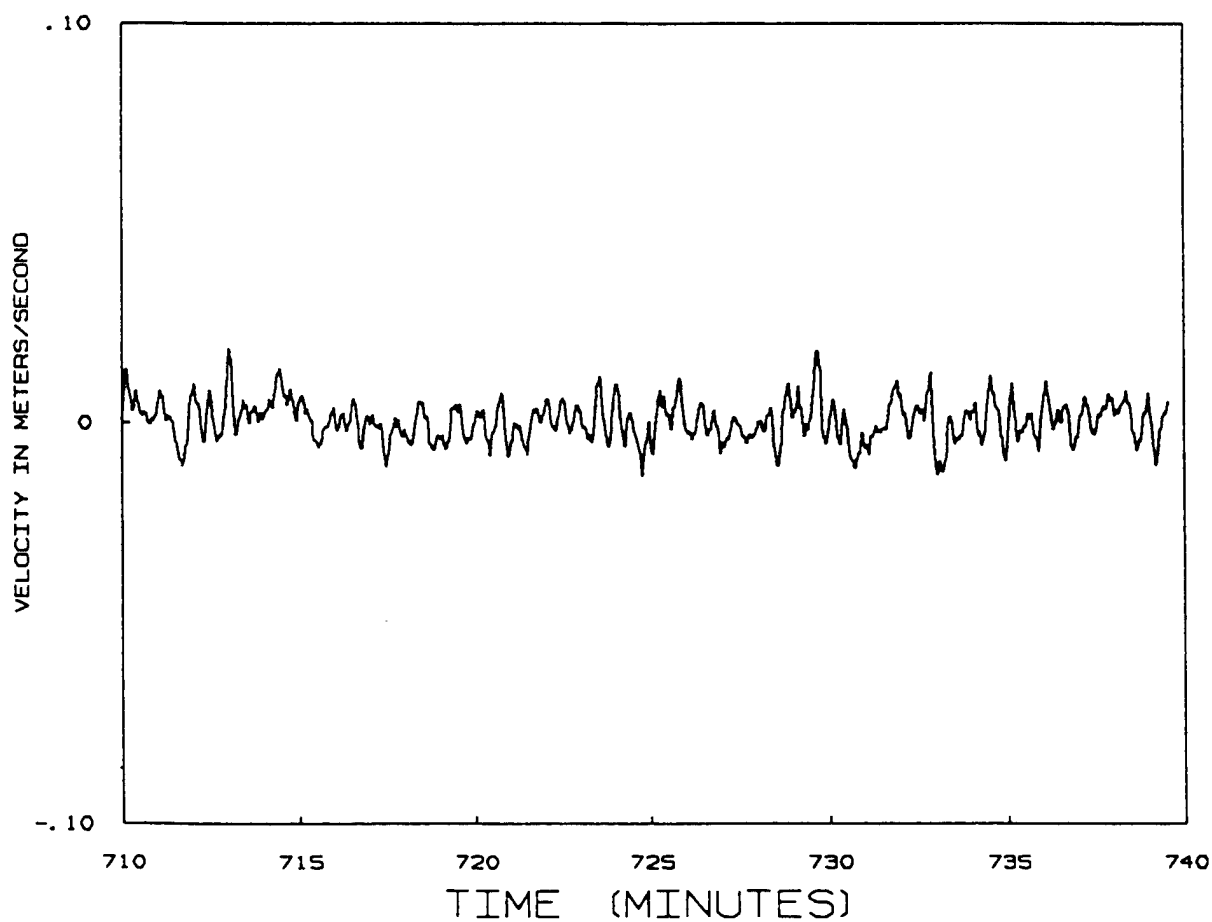
meter number	1130	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.12
speed	5.3 mph	vmax =	0.23 tmax = 728.
direction	upstream	vmin =	0.08 tmin = 732.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT



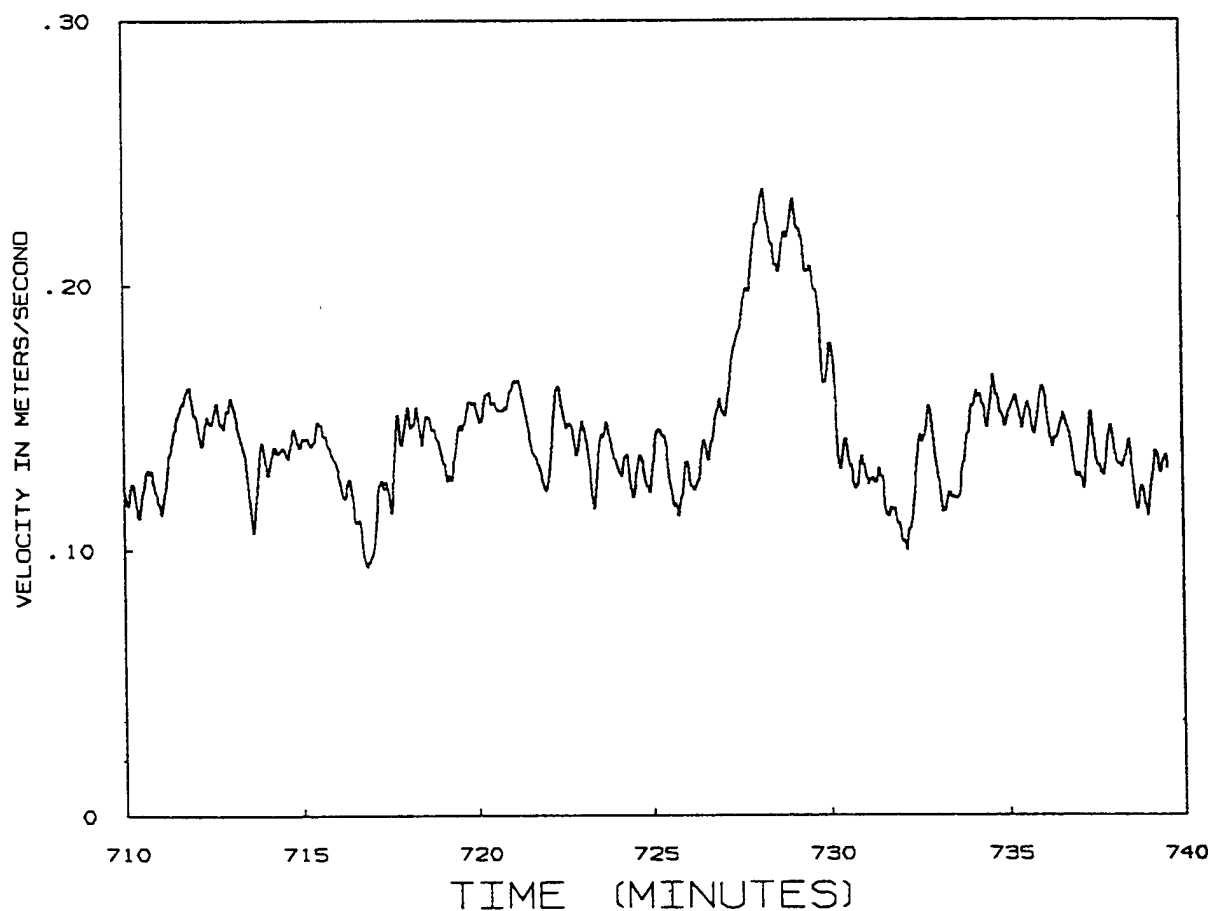
meter number	1130	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.00
speed	5.3 mph	vmax =	0.02 tmax = 713.
direction	upstream	vmin =	-0.01 tmin = 725.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



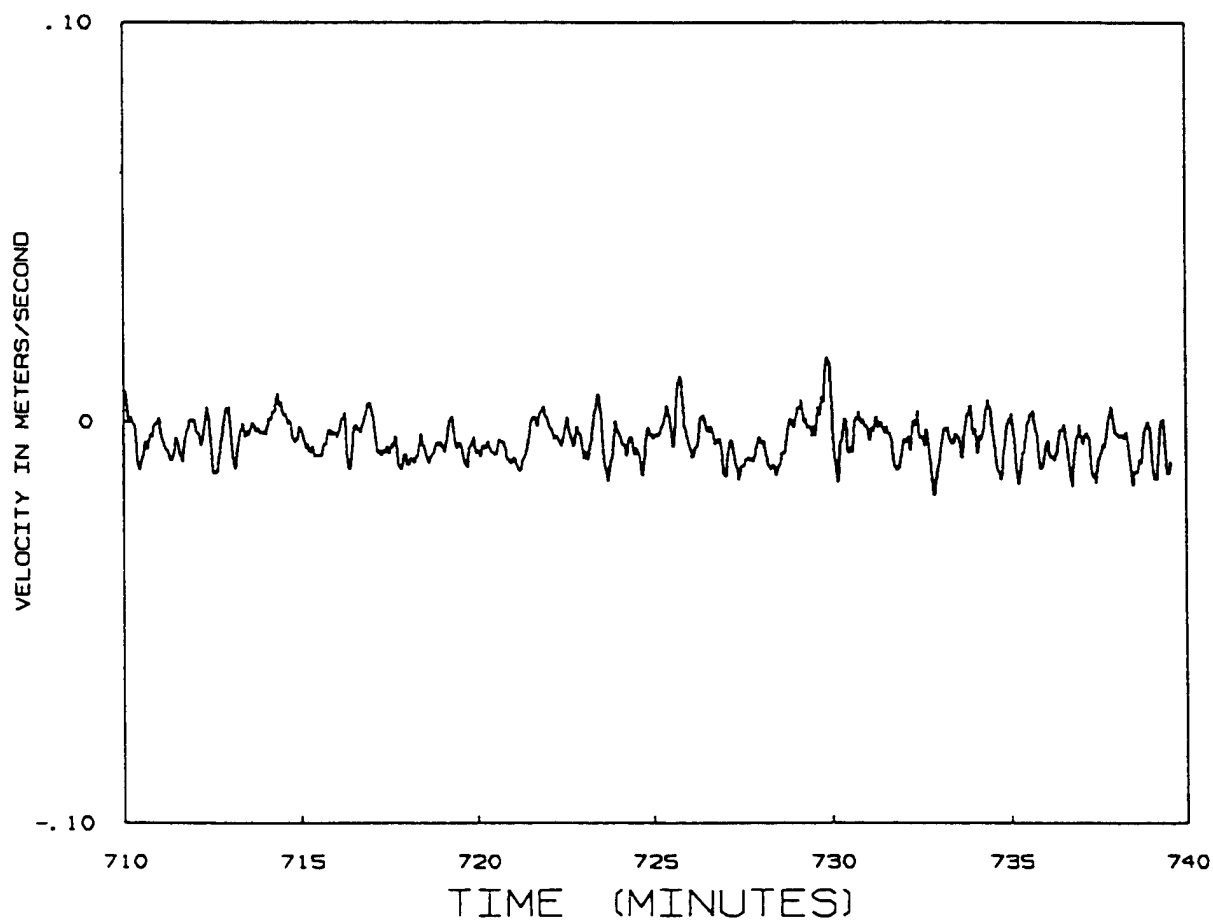
meter number	1131	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.14
speed	5.3 mph	vmax =	0.24 tmax = 728.
direction	upstream	vmin =	0.09 tmin = 717.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT X - COMPONENT

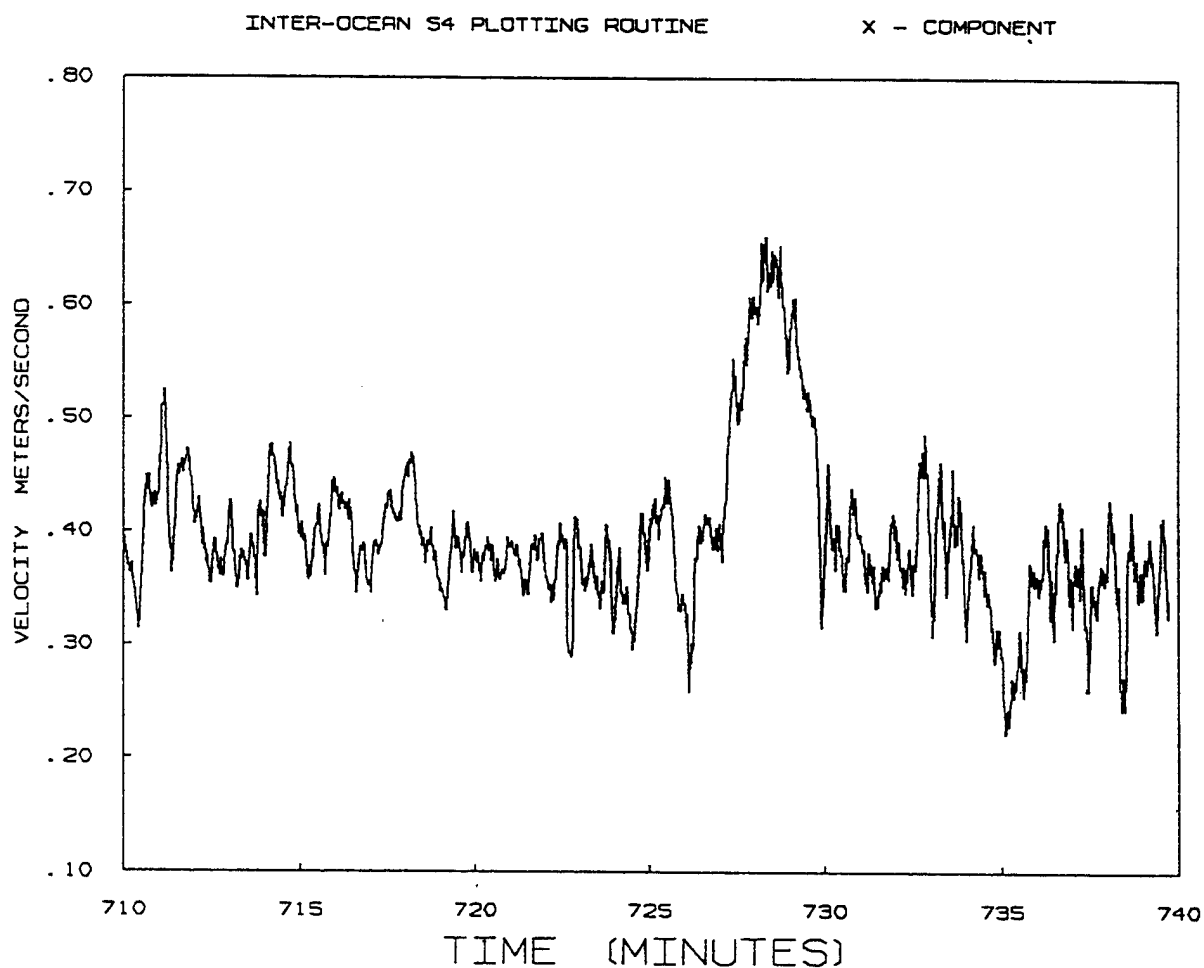


meter number	1131	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	mean =	0.00
speed	5.3 mph	vmax =	0.02 tmax = 730.
direction	upstream	vmin =	-0.02 tmin = 733.

MARSH MCBIRNEY S11/LOGGER2 PLOTTING ROUT Y - COMPONENT



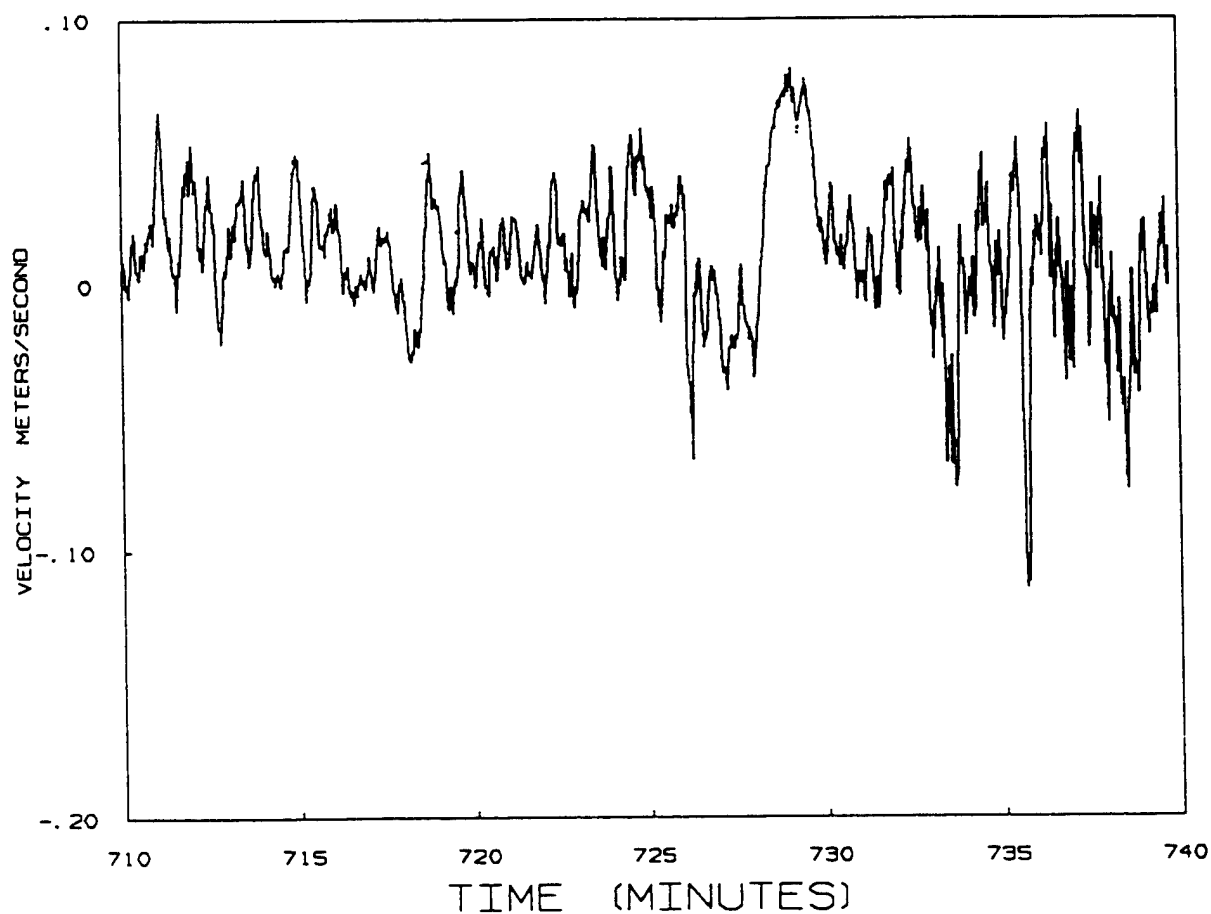
meter number	834	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	MEAN =	0.40
speed	5.3 mph	VMAX =	0.66 TMAX = 728.
direction	upstream	VMIN =	0.22 TMIN = 735.



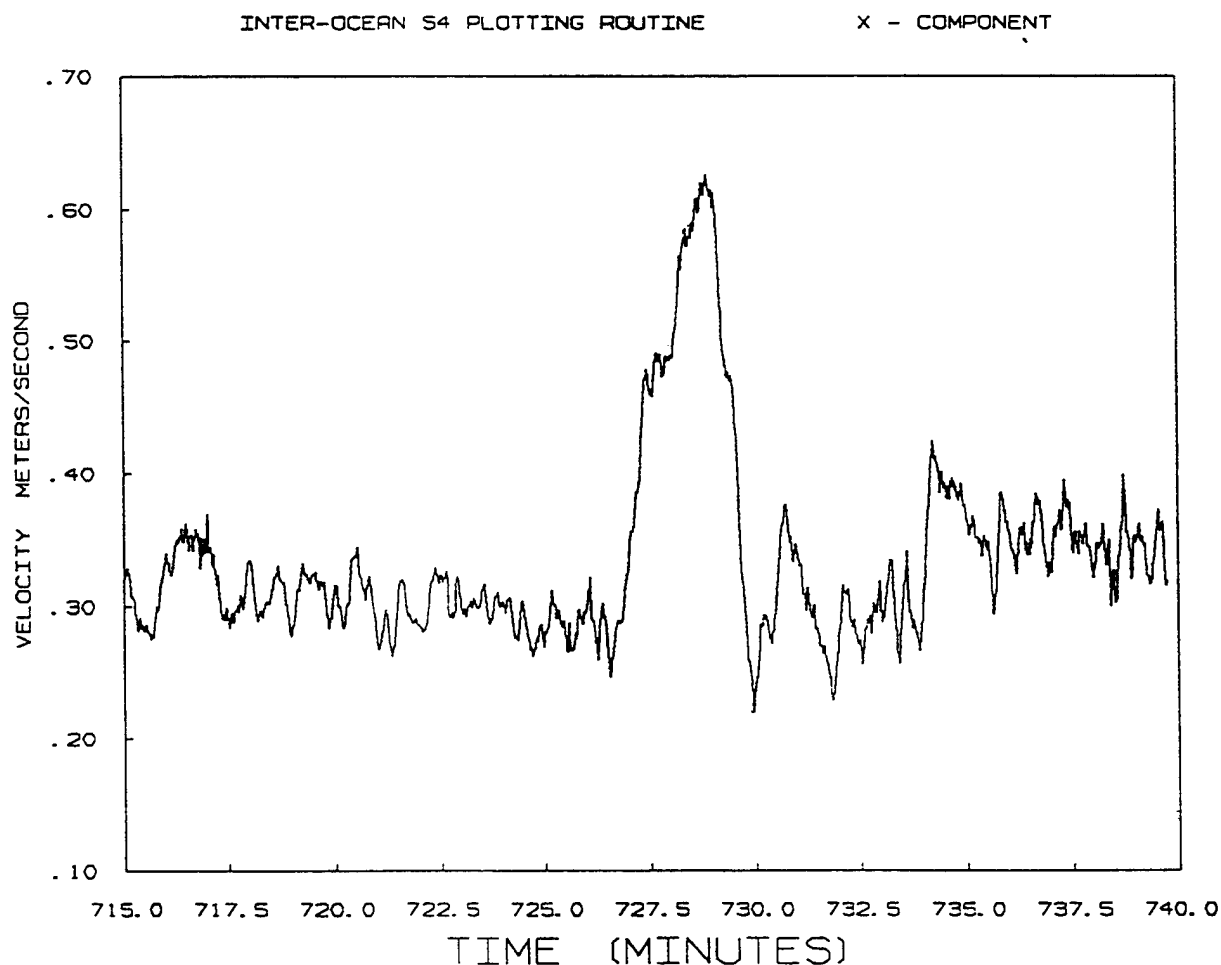
meter number	834	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	MEAN =	0.01
speed	5.3 mph	VMAX =	0.08 TMAX = 729.
direction	upstream	VMIN =	-0.11 TMIN = 736.

INTER-OCEAN S4 PLOTTING ROUTINE

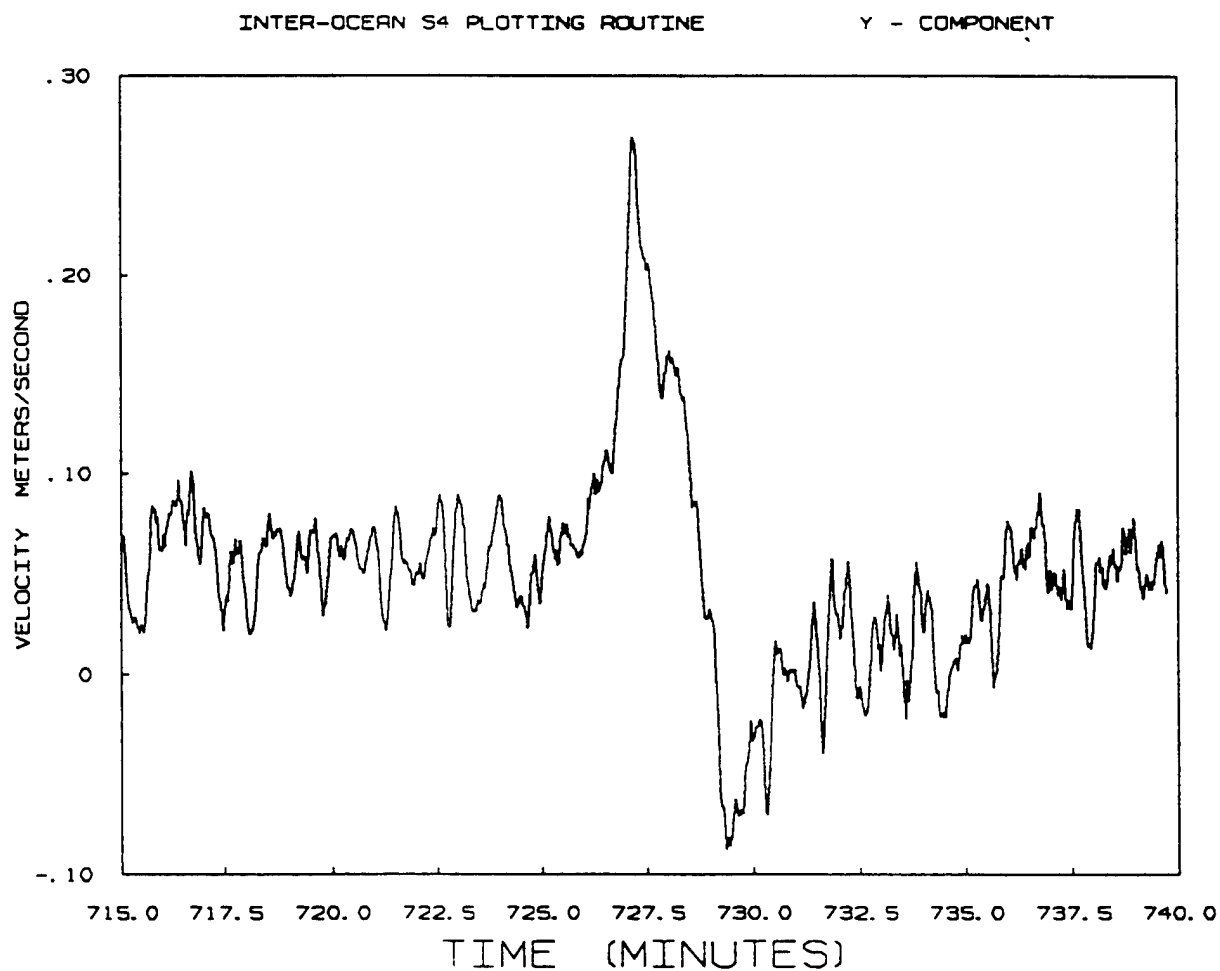
Y - COMPONENT



meter number	151	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	MEAN =	0.31
speed	5.3 mph	VMAX =	0.63 TMAX = 729.
direction	upstream	VMIN =	0.22 TMIN = 730.



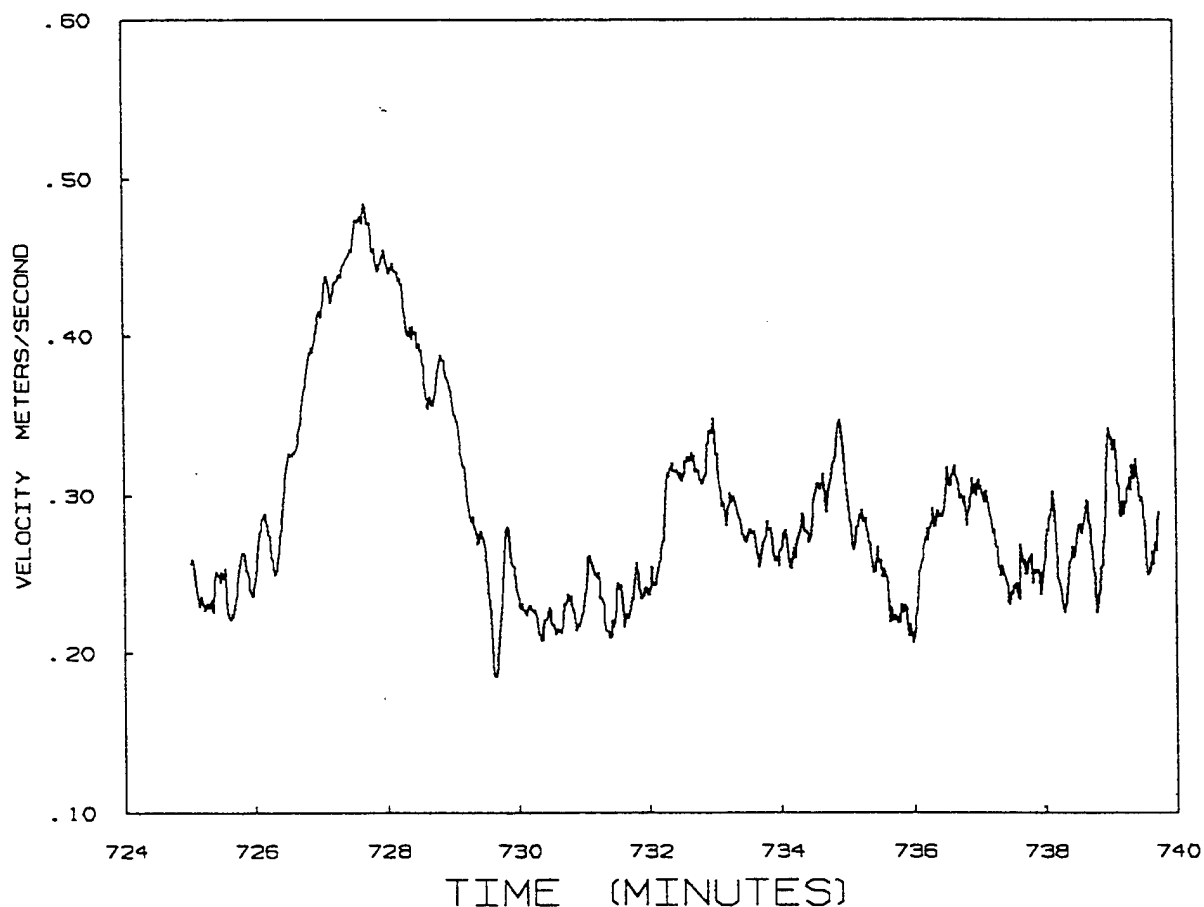
meter number	151	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	MEAN =	0.06
speed	5.3 mph	VMAX =	0.27 TMAX = 727.
direction	upstream	VMIN =	-0.09 TMIN = 729.



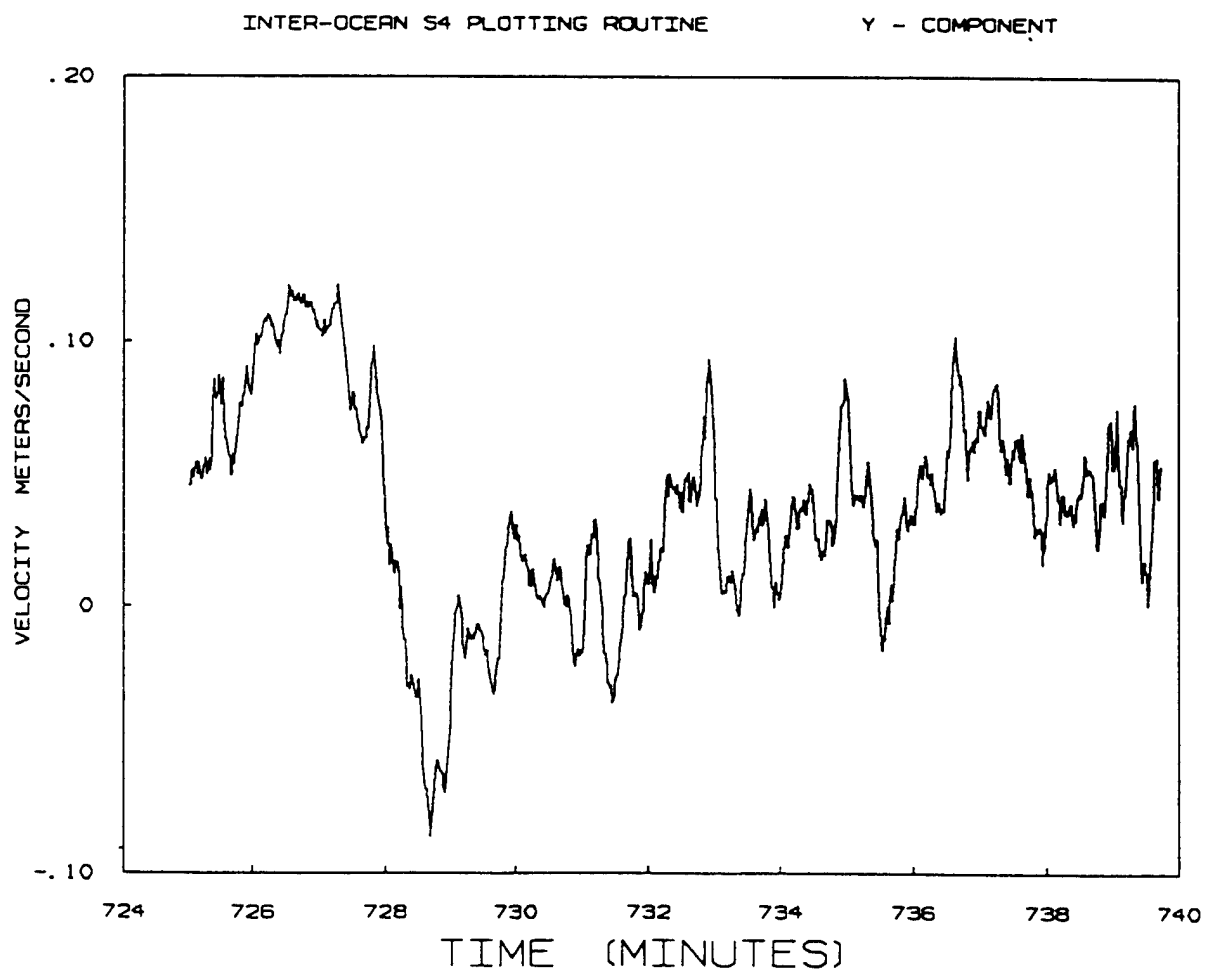
meter number	832	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	MEAN =	0.30
speed	5.3 mph	VMAX =	0.48 TMAX = 728.
direction	upstream	VMIN =	0.18 TMIN = 730.

INTER-OCEAN S4 PLOTTING ROUTINE

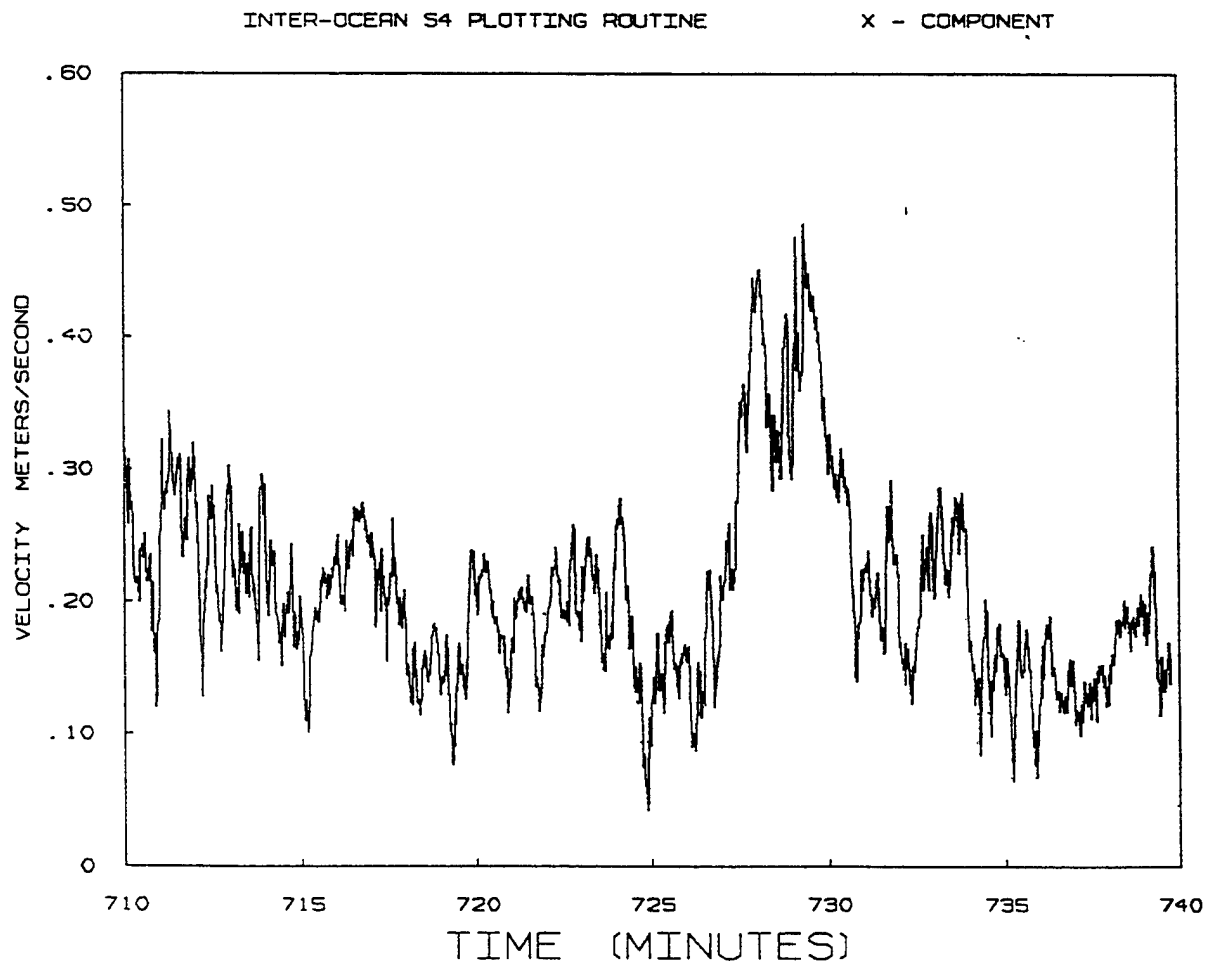
X - COMPONENT



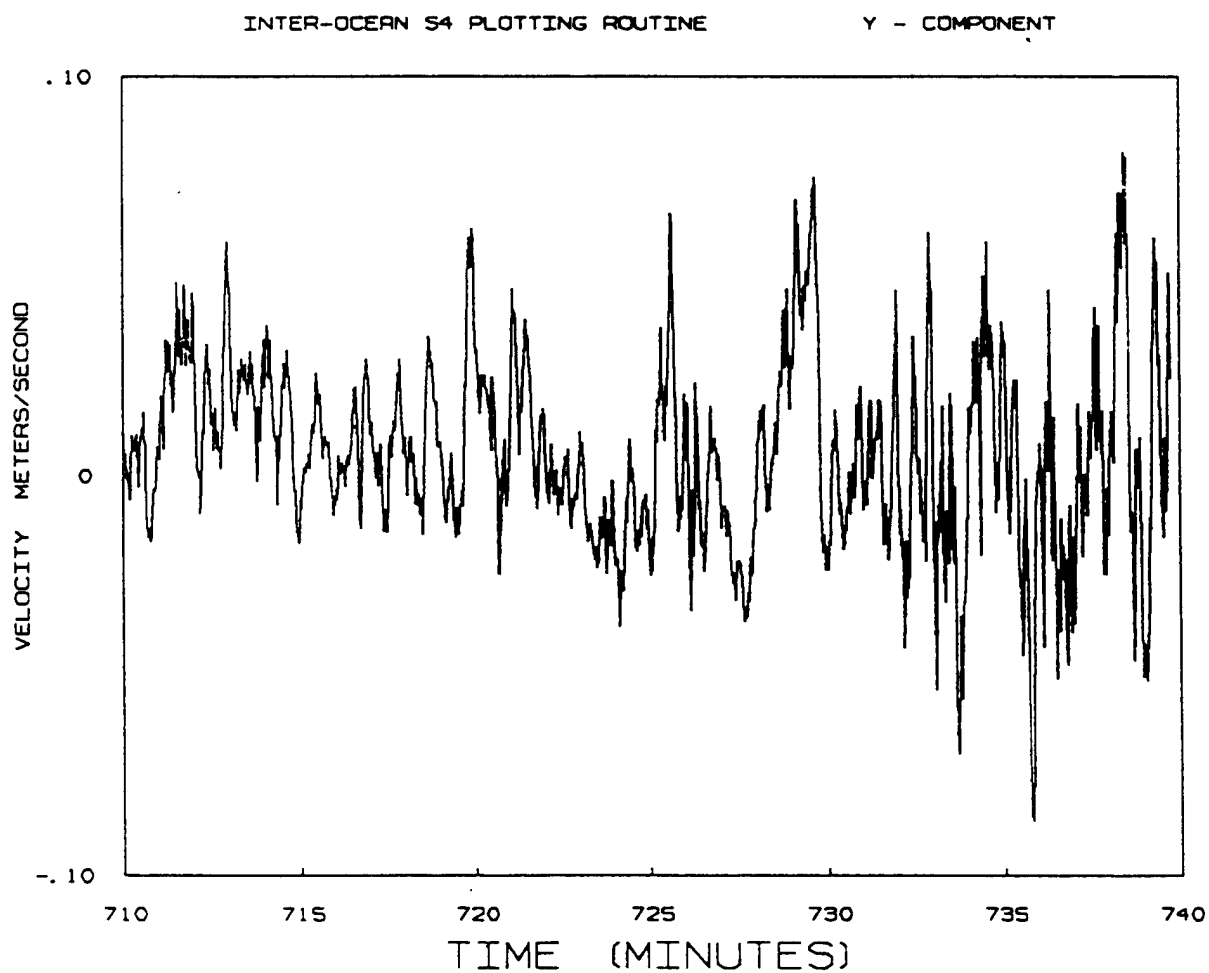
meter number	832	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	MEAN =	0.03
speed	5.3 mph	VMAX =	0.12 TMAX = 727.
direction	upstream	VMIN =	-0.09 TMIN = 729.



meter number	040	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	MEAN =	0.21
speed	5.3 mph	VMAX =	0.49 TMAX = 729.
direction	upstream	VMIN =	0.04 TMIN = 725.

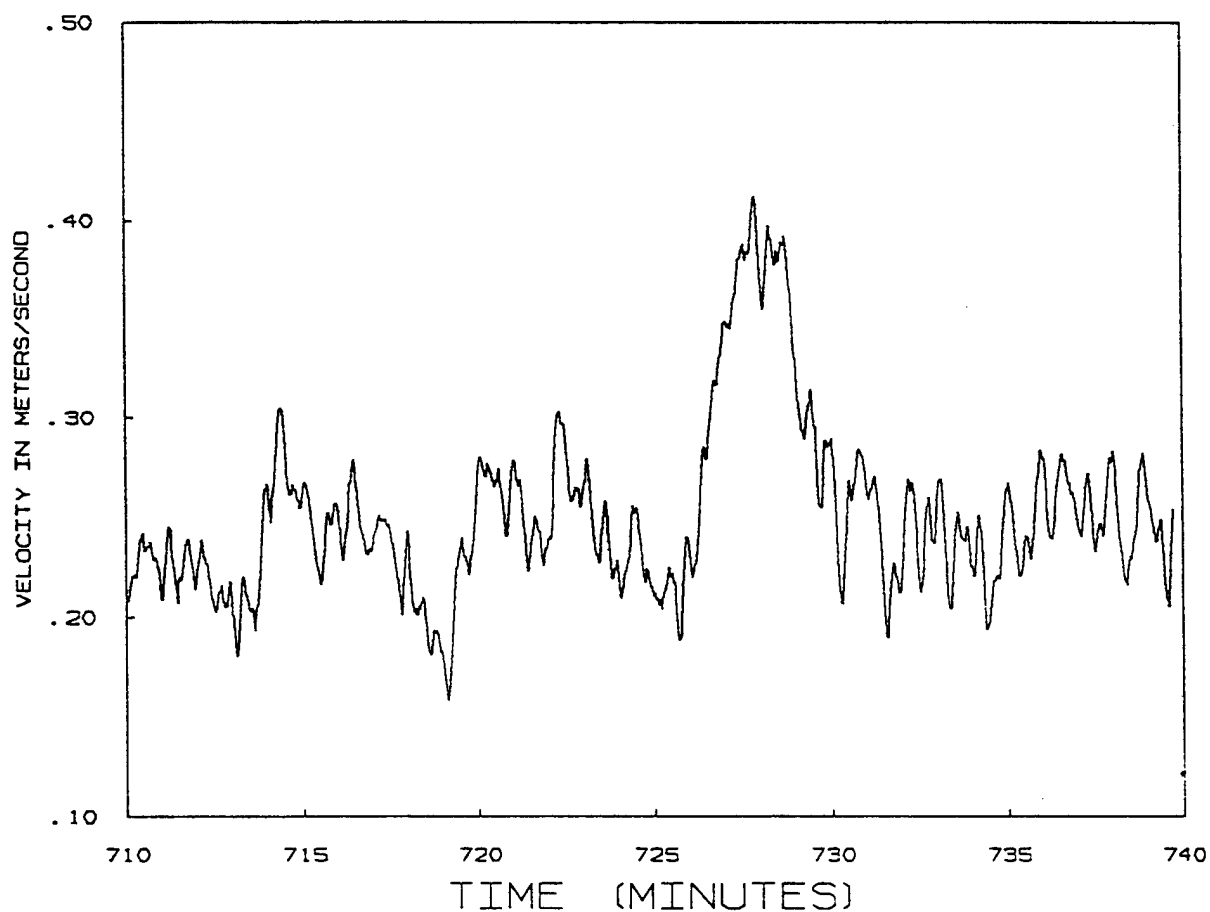


meter number	040	distance	215
tow name	Jack Bullard	start-time	1150
configuration	2x1+3x4	end-time	1220
draft	9.0	MEAN =	0.01
speed	5.3 mph	VMAX =	0.08 TMAX = 738.
direction	upstream	VMIN =	-0.09 TMIN = 736.



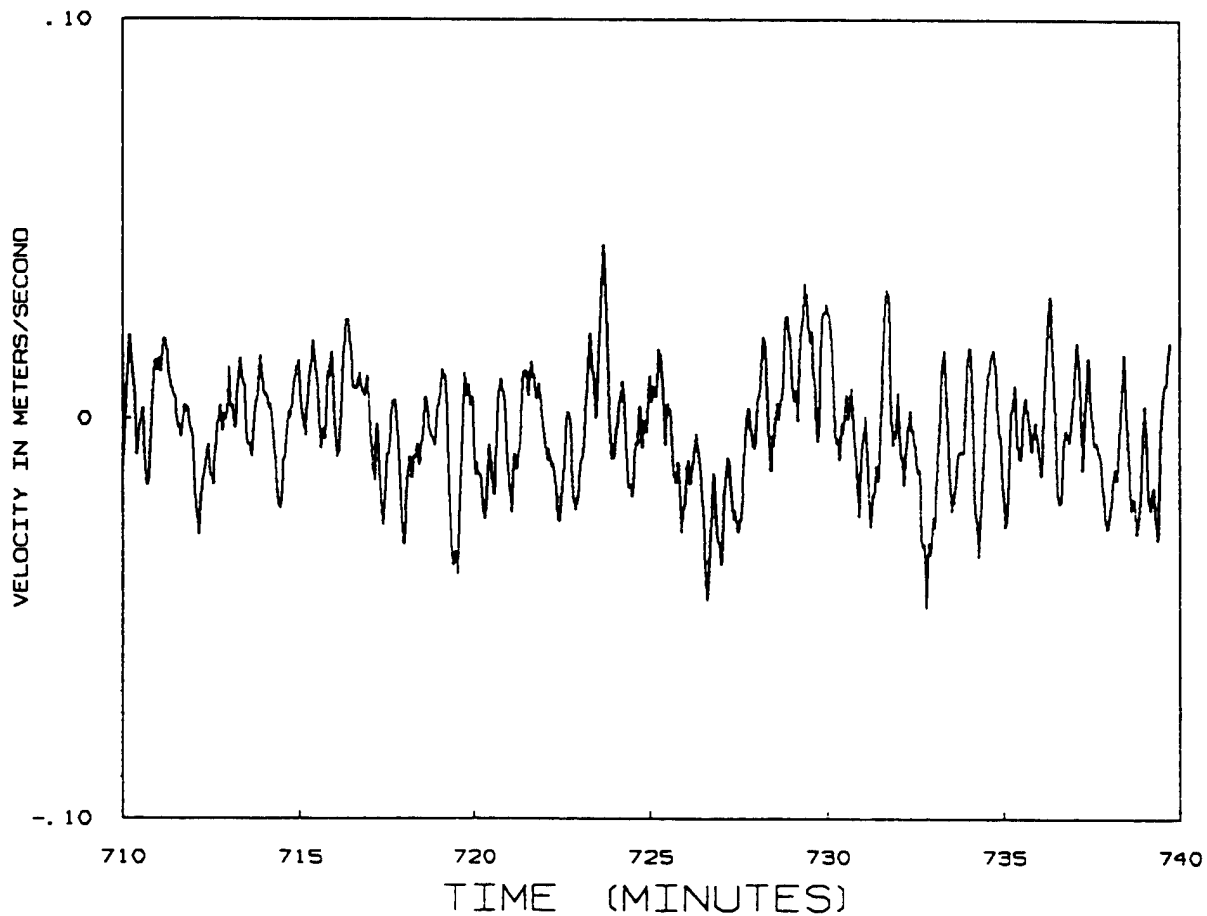
meter number	B-332	start-time	1150
tow name	Jack Bullard	end-time	1220
configuration	2x1+3x4	mean =	0.23
draft	9.0	vmax =	0.00 tmax = 728.
speed	5.3 mph	vmin =	0.00 tmin = 719.
direction	upstream		
distance	215		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



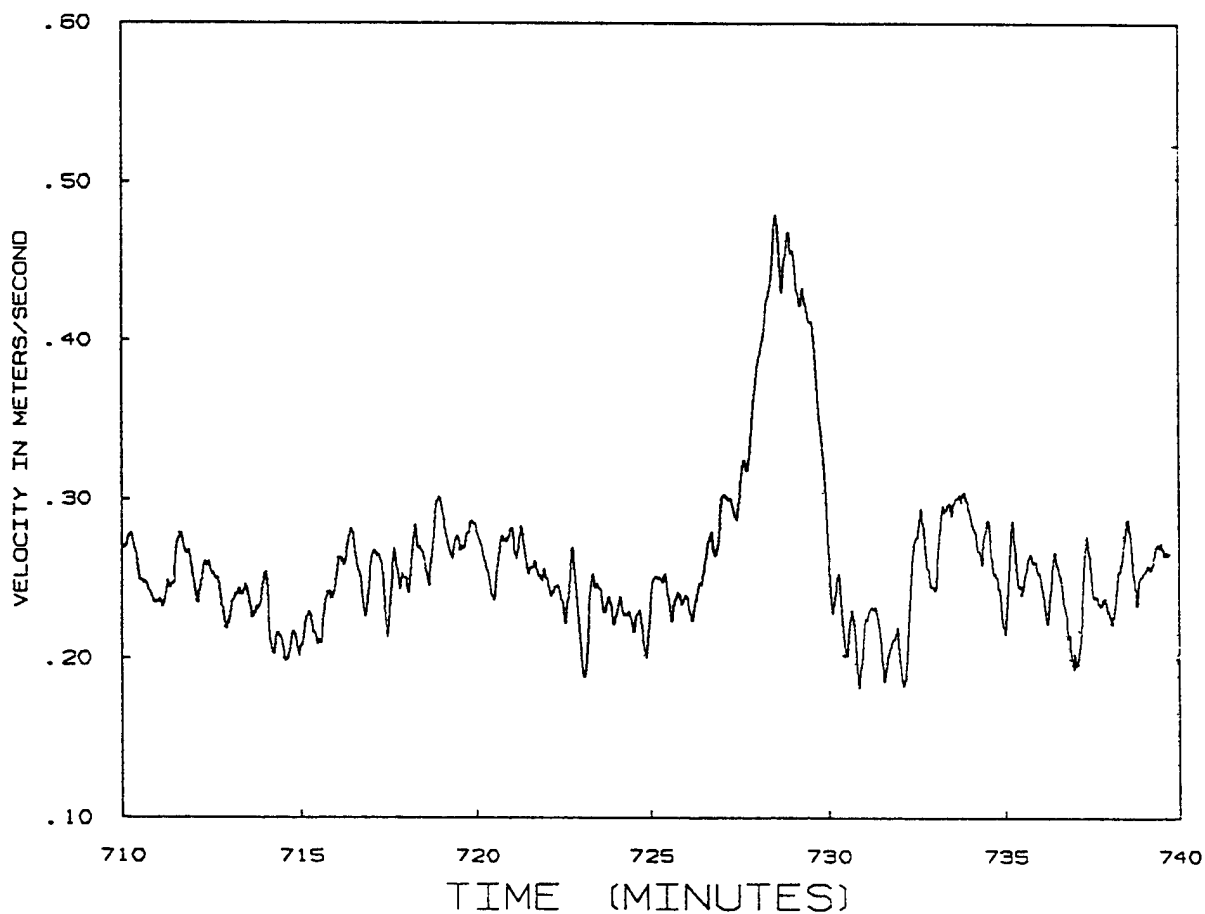
meter number	B-332	start-time	1150
tow name	Jack Bullard	end-time	1220
configuration	2x1+3x4	mean =	0.00
draft	9.0	vmax =	0.00 tmax = 724.
speed	5.3 mph	vmin =	0.00 tmin = 733.
direction	upstream		
distance	215		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT



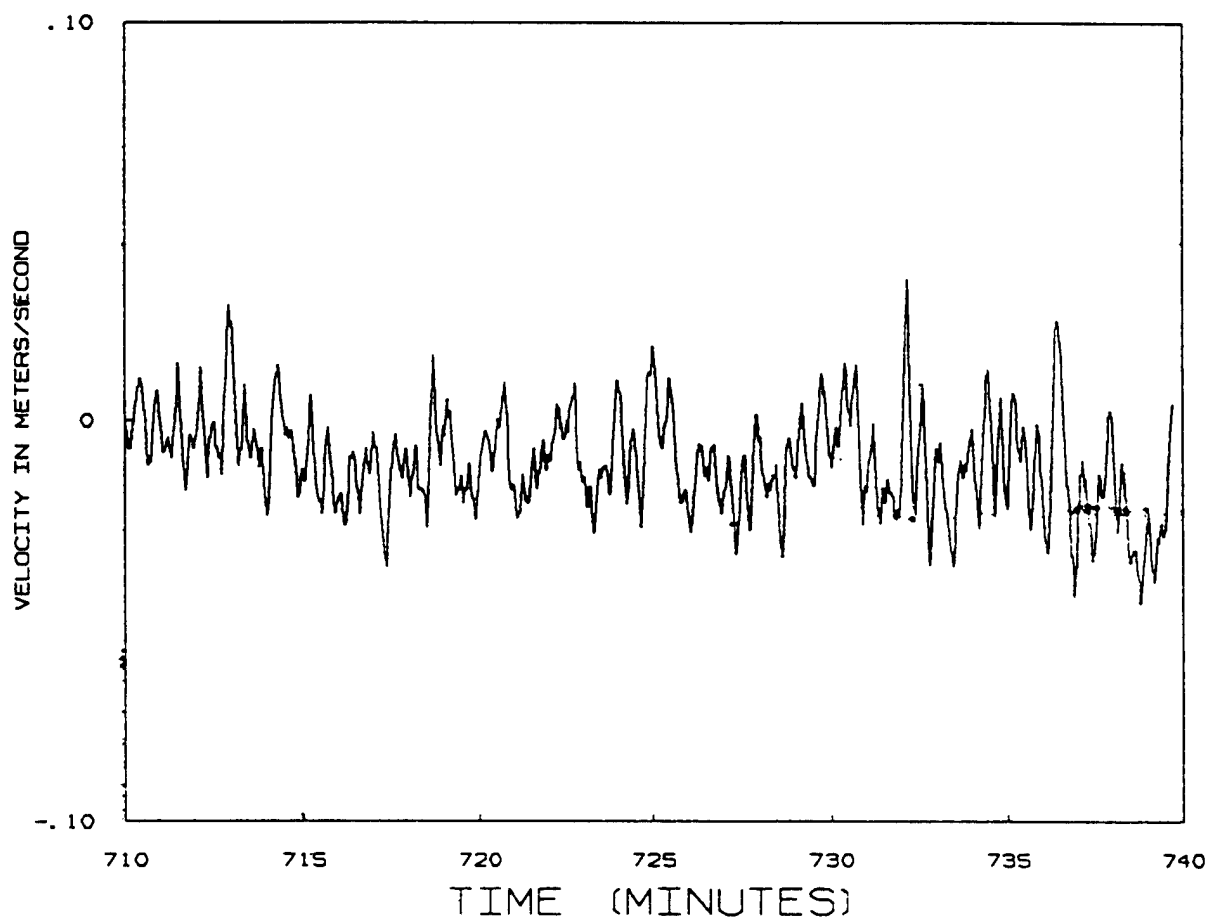
meter number	B-642	start-time	1150
tow name	Jack Bullard	end-time	1220
configuration	2x1+3x4	mean =	0.25
draft	9.0	vmax =	0.00 tmax = 729.
speed	5.3 mph	vmin =	0.00 tmin = 731.
direction	upstream		
distance	215		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE X - COMPONENT



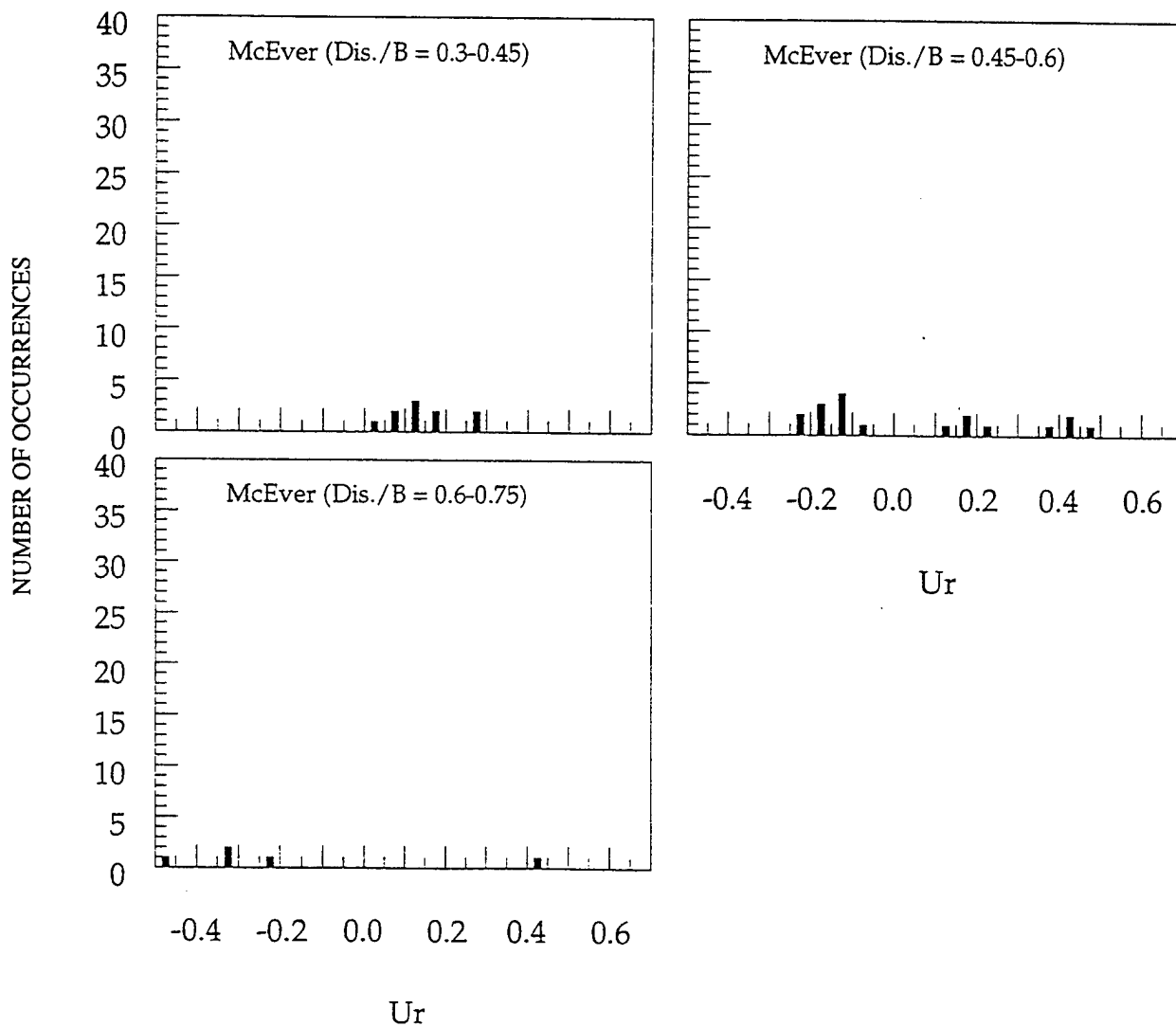
meter number	B-642	start-time	1150
tow name	Jack Bullard	end-time	1220
configuration	2x1+3x4	mean	= -0.01
draft	9.0	vmax	= 0.00 tmax = 732.
speed	5.3 mph	vmin	= 0.00 tmin = 739.
direction	upstream		
distance	215		

MARSH MCBIRNEY 511/527 PLOTTING ROUTINE Y - COMPONENT

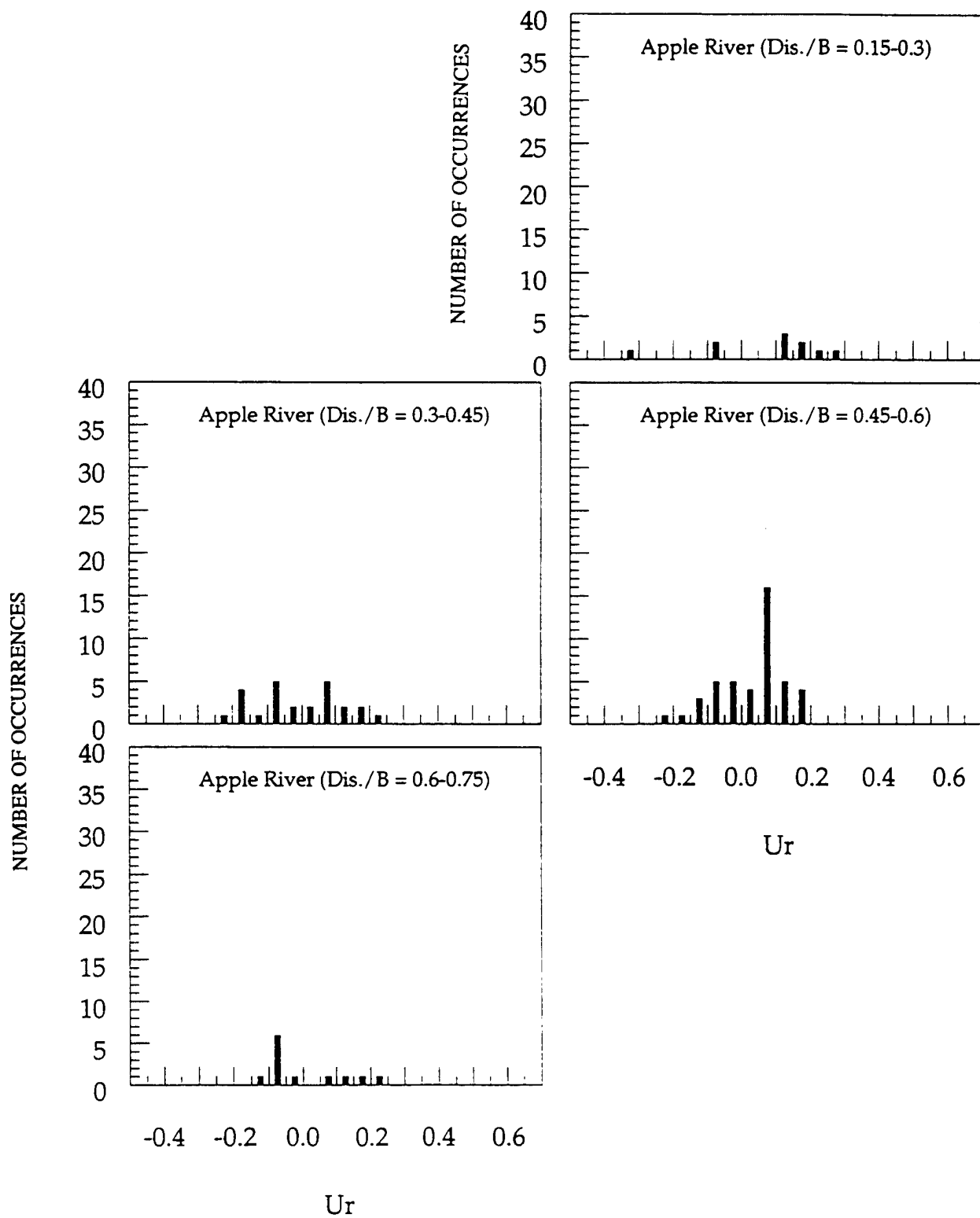


APPENDIX XXI.

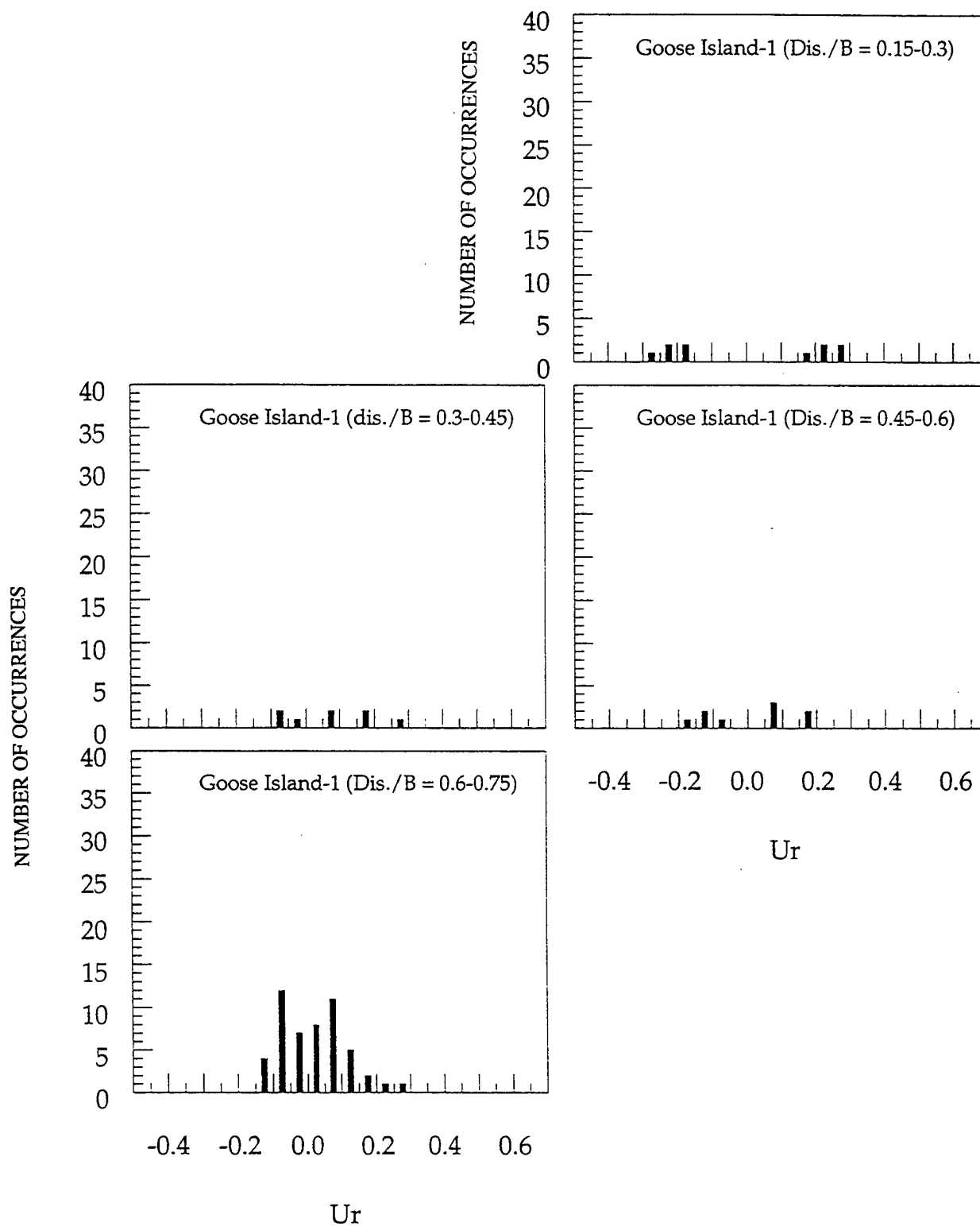
**HISTOGRAMS OF MAXIMUM RETURN VELOCITY
WITHIN VARIOUS ZONES FOR ALL STUDY SITES**



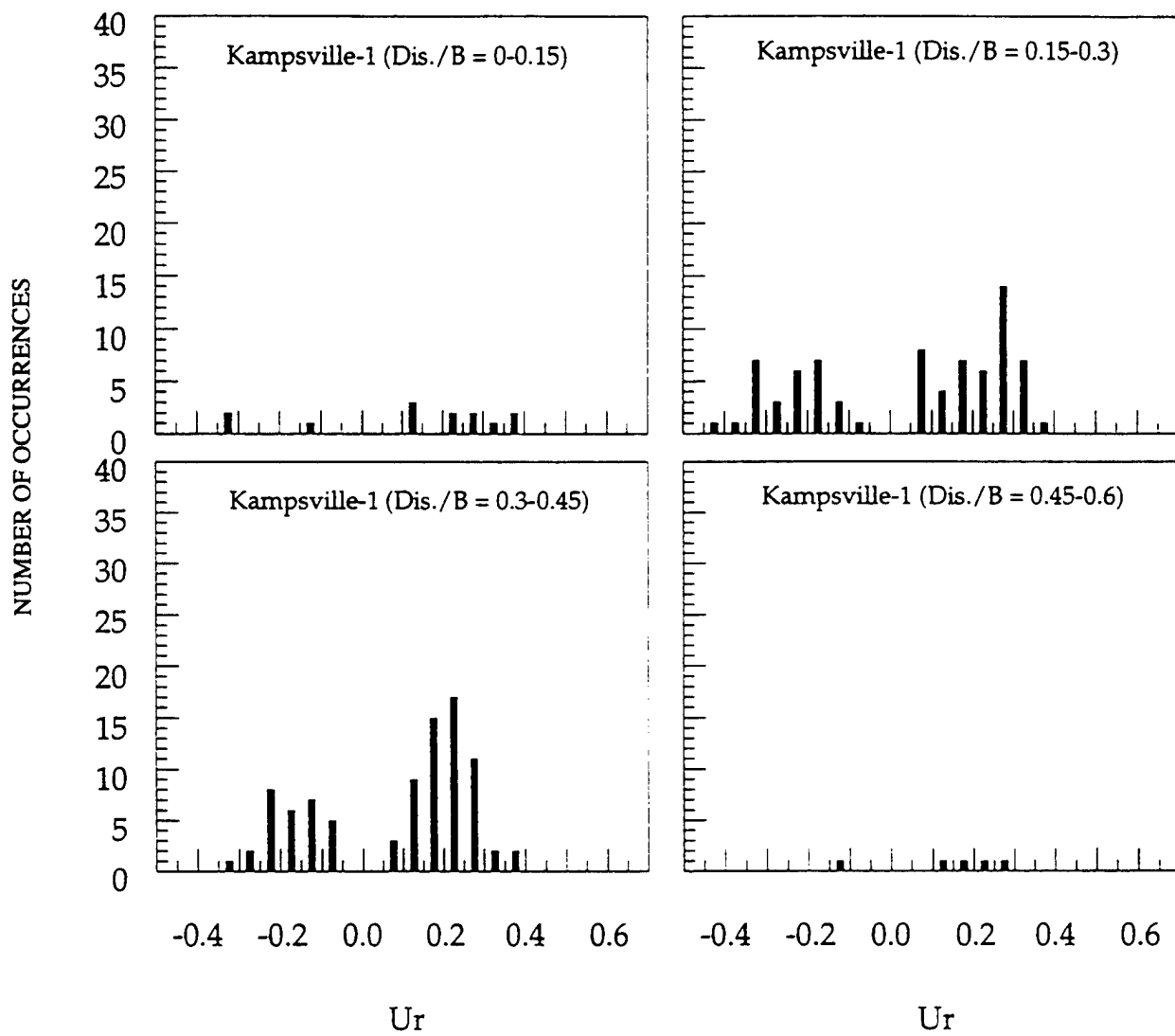
XXI-1. Histograms of $U_{r(max)}$ within various zones, McEver's Island
($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



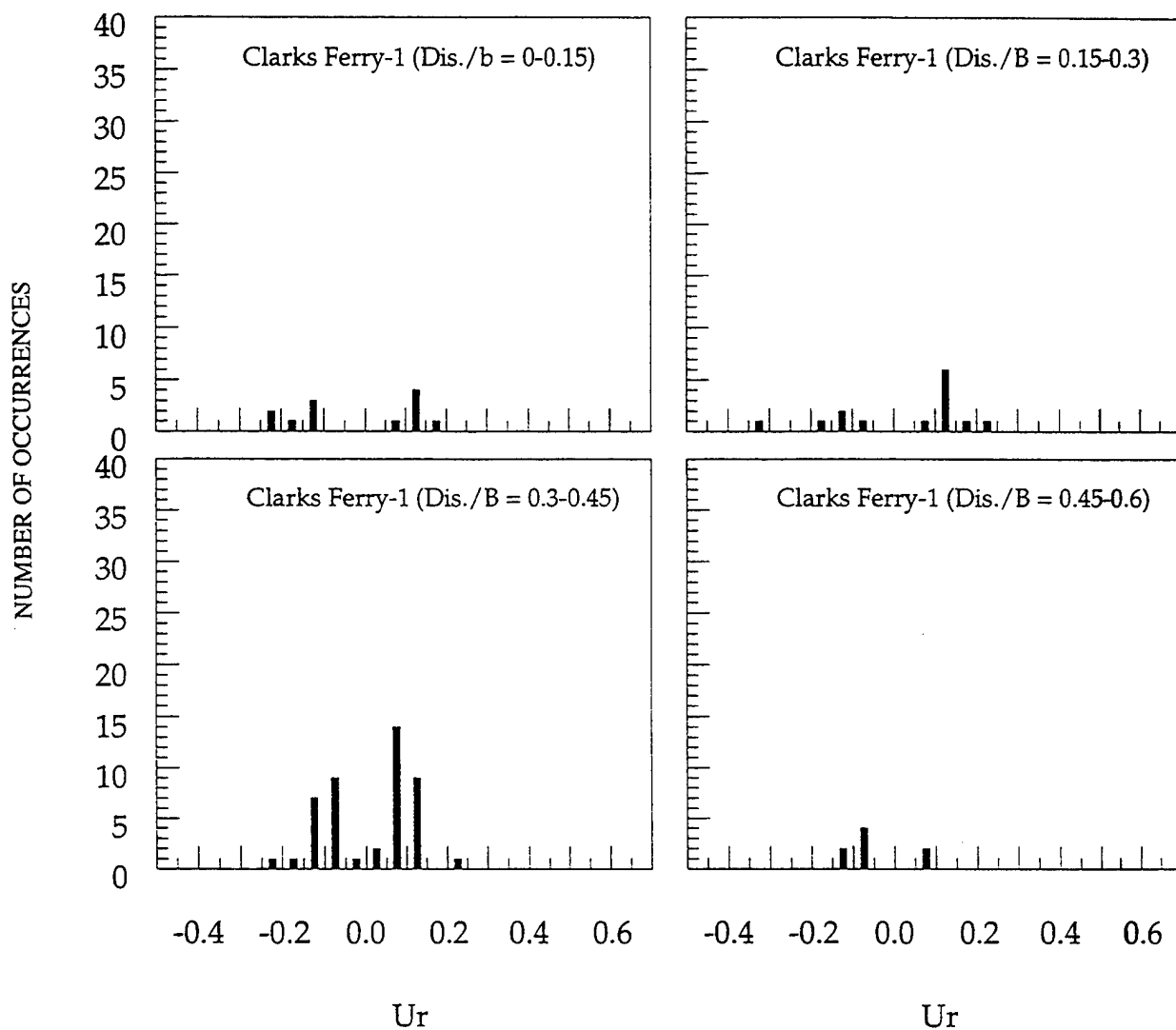
XXI-2. Histograms of $U_{r(max)}$ within various zones, Apple River Island
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



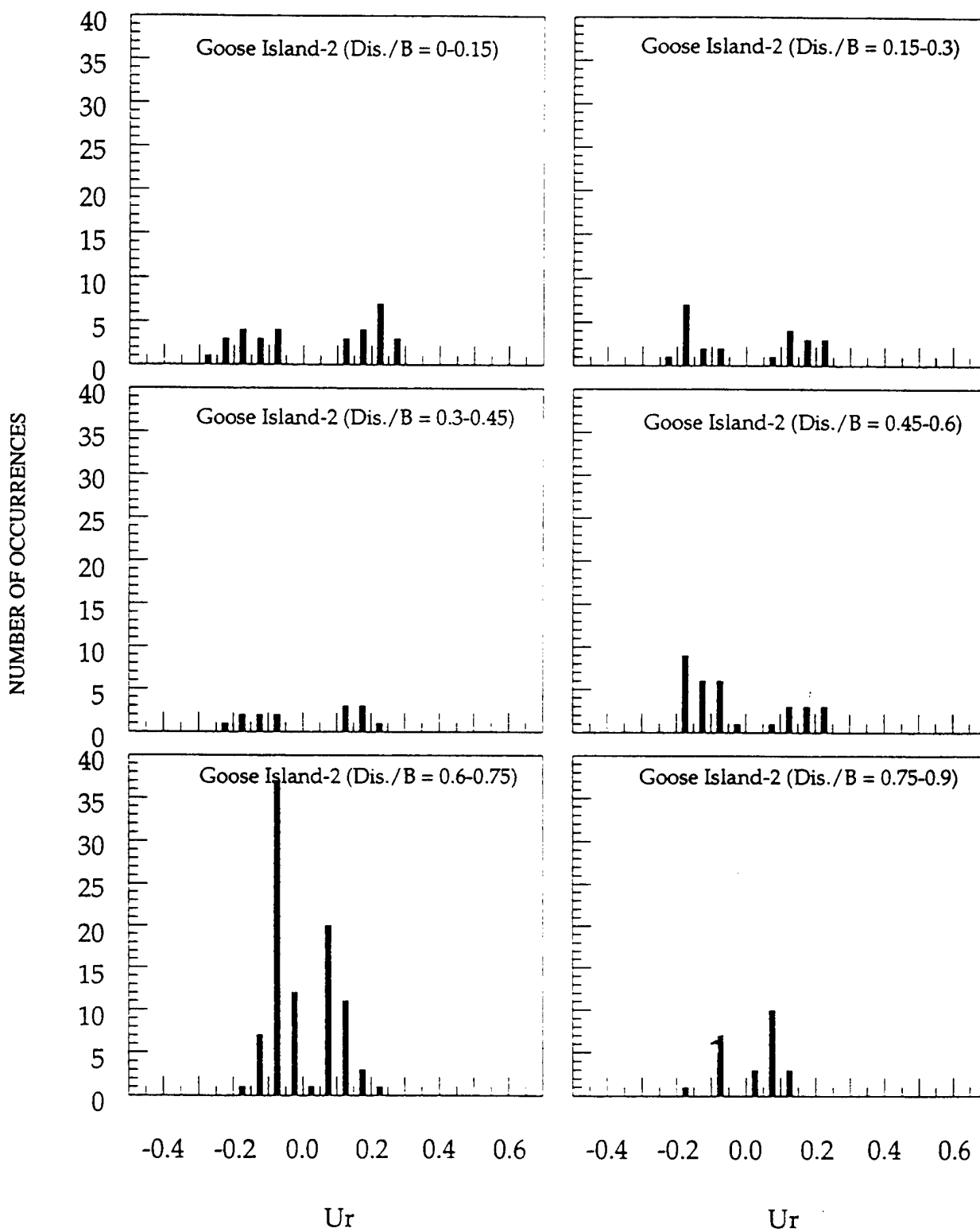
XXI-3. Histograms of $U_{r(max)}$ within various zones, Goose Island, trip 1
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



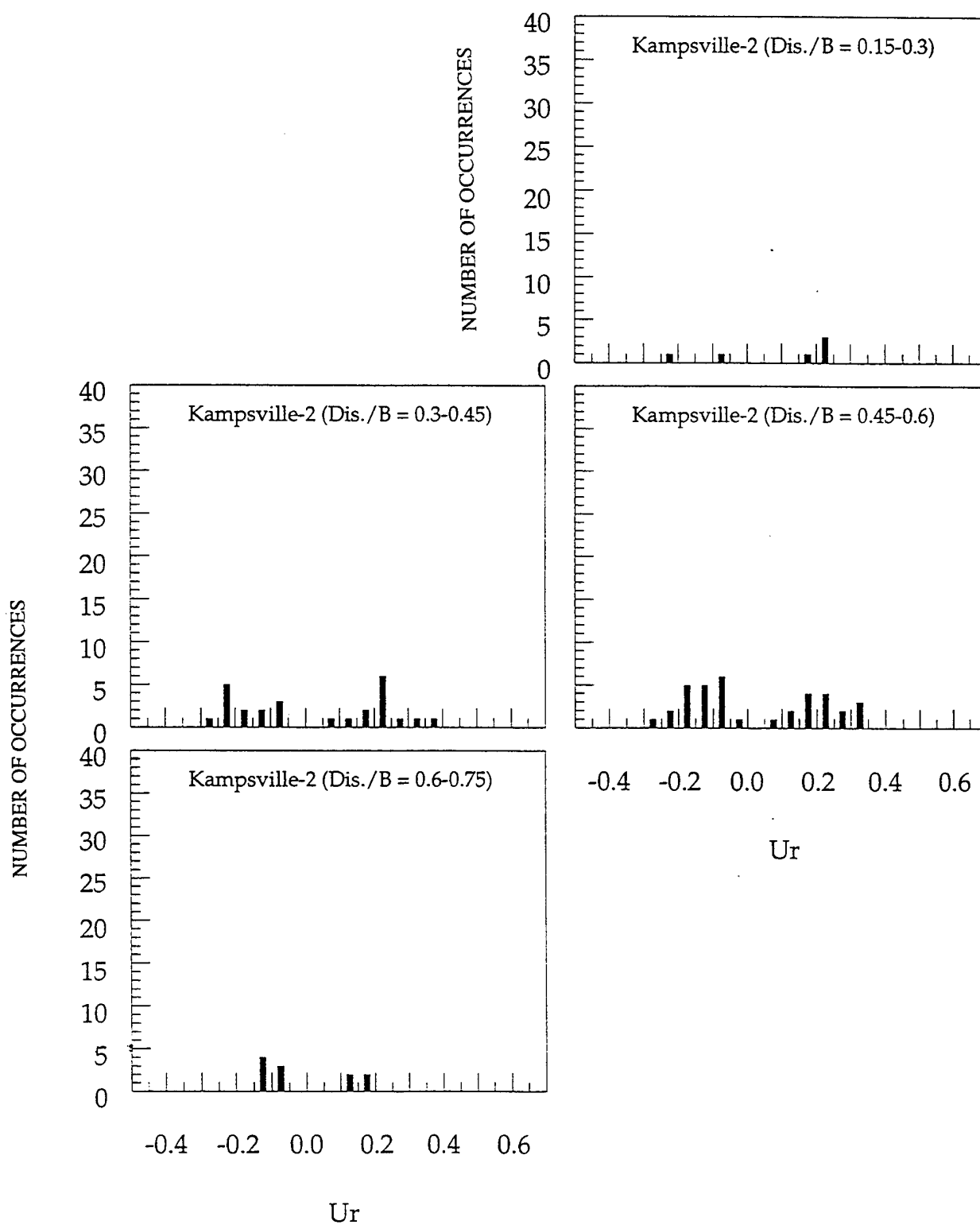
XXI-4. Histograms of $U_{r(max)}$ within various zones, Kampsville, trip 1
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



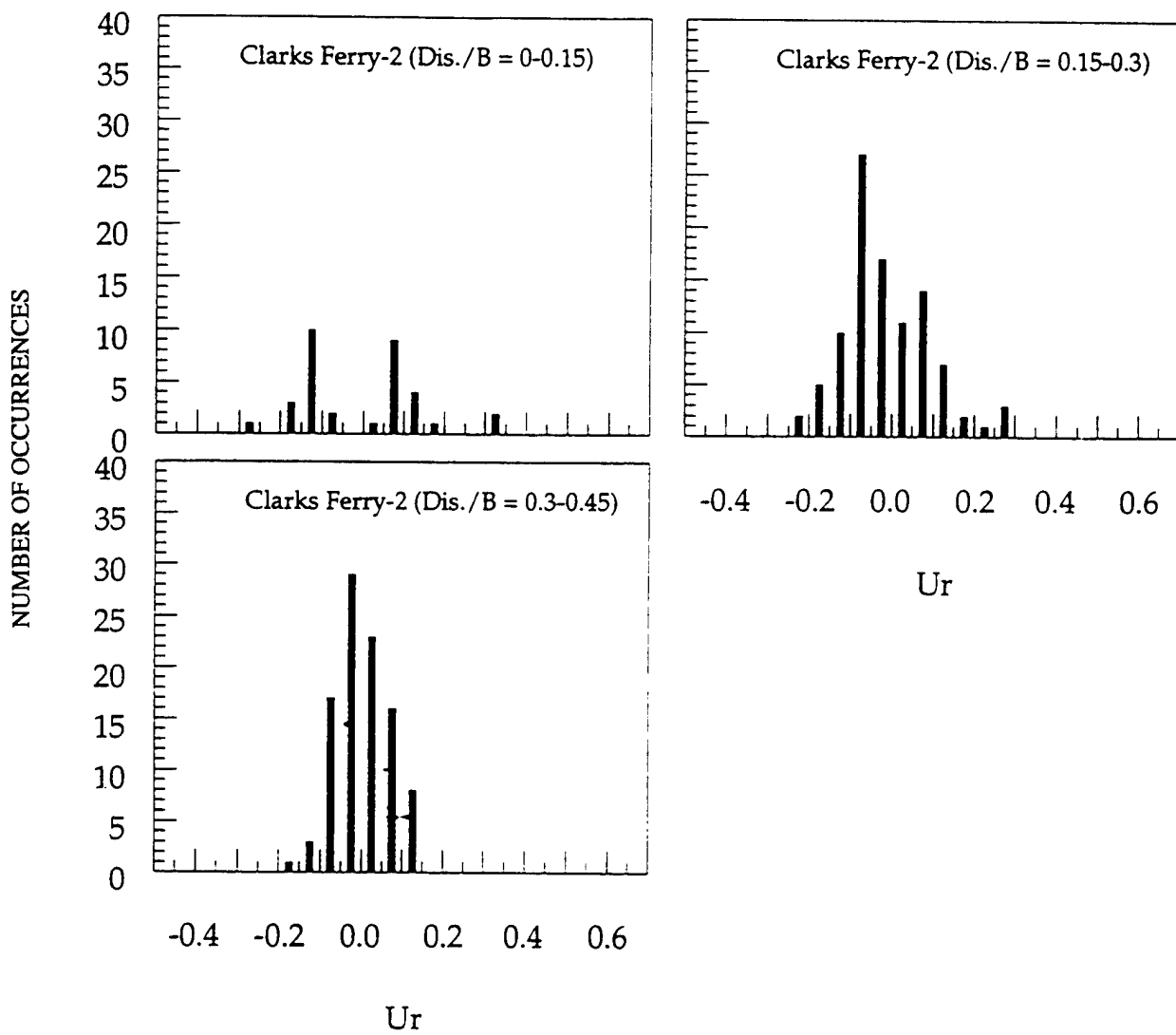
XXI-5. Histograms of $U_{r(max)}$ within various zones, Clarks Ferry, trip 1
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



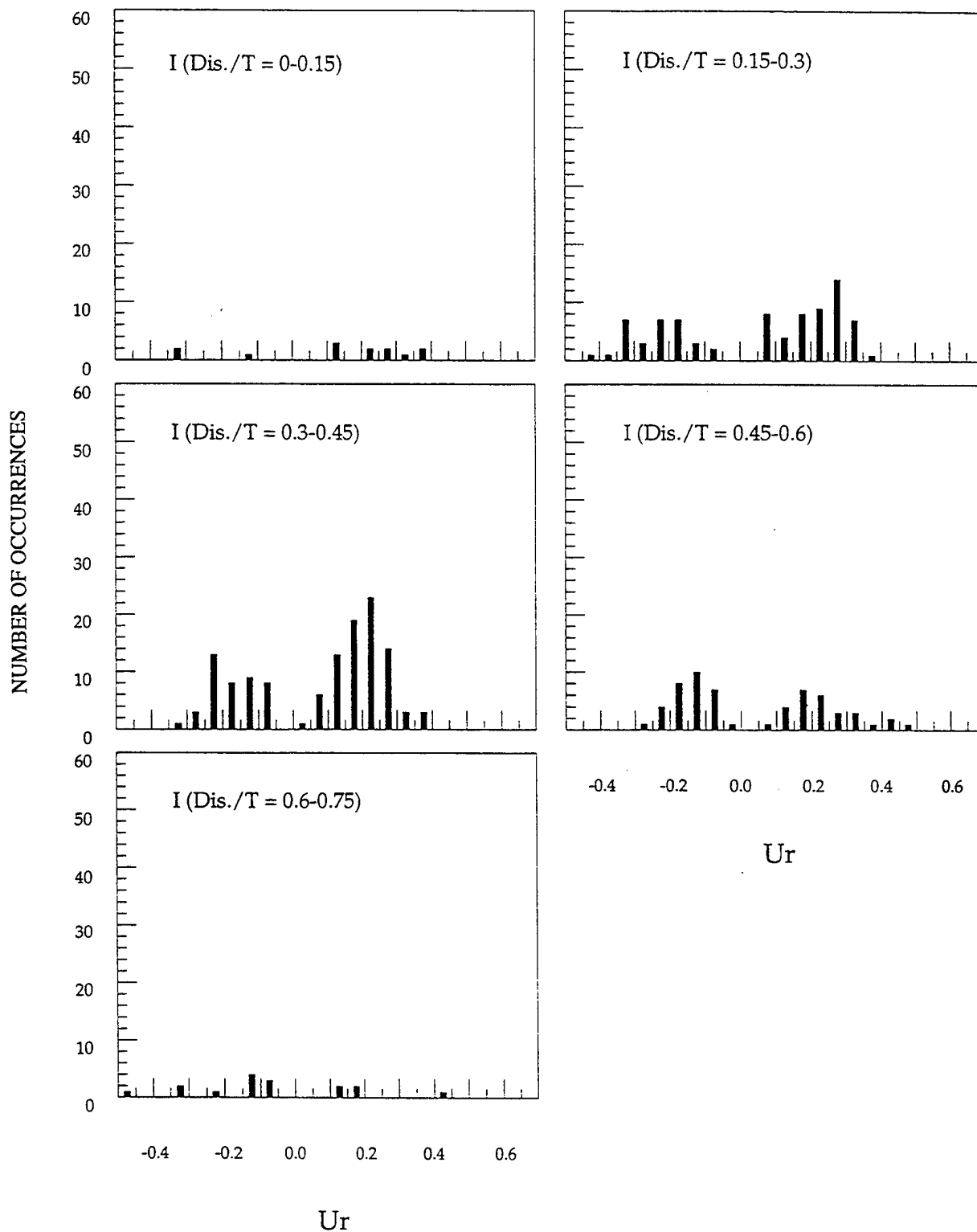
XXI-6. Histograms of $U_{r(max)}$ within various zones, Goose Island, trip 2
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



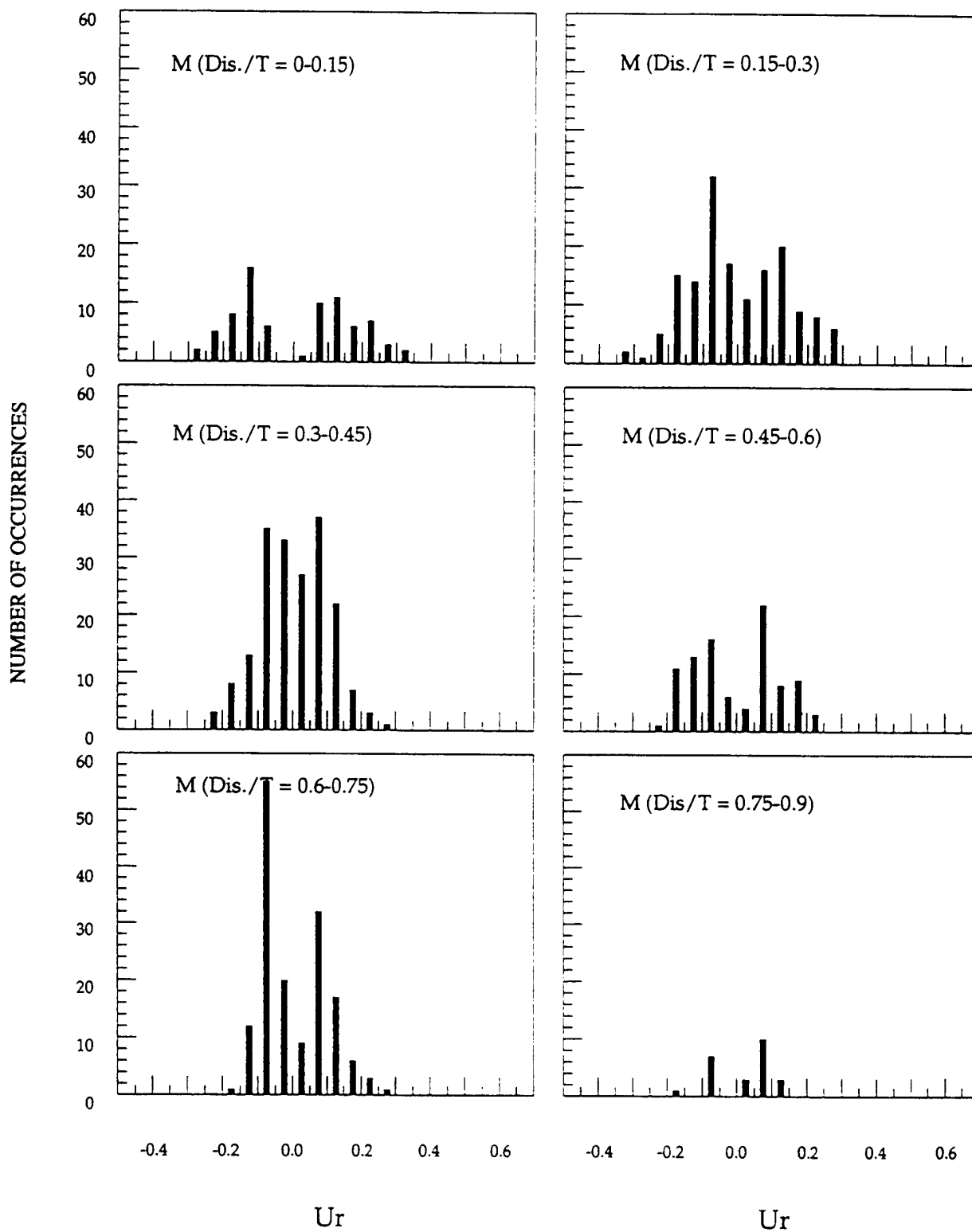
XXI-7. Histograms of $U_{r(max)}$ within various zones, Kampsville, trip 2
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



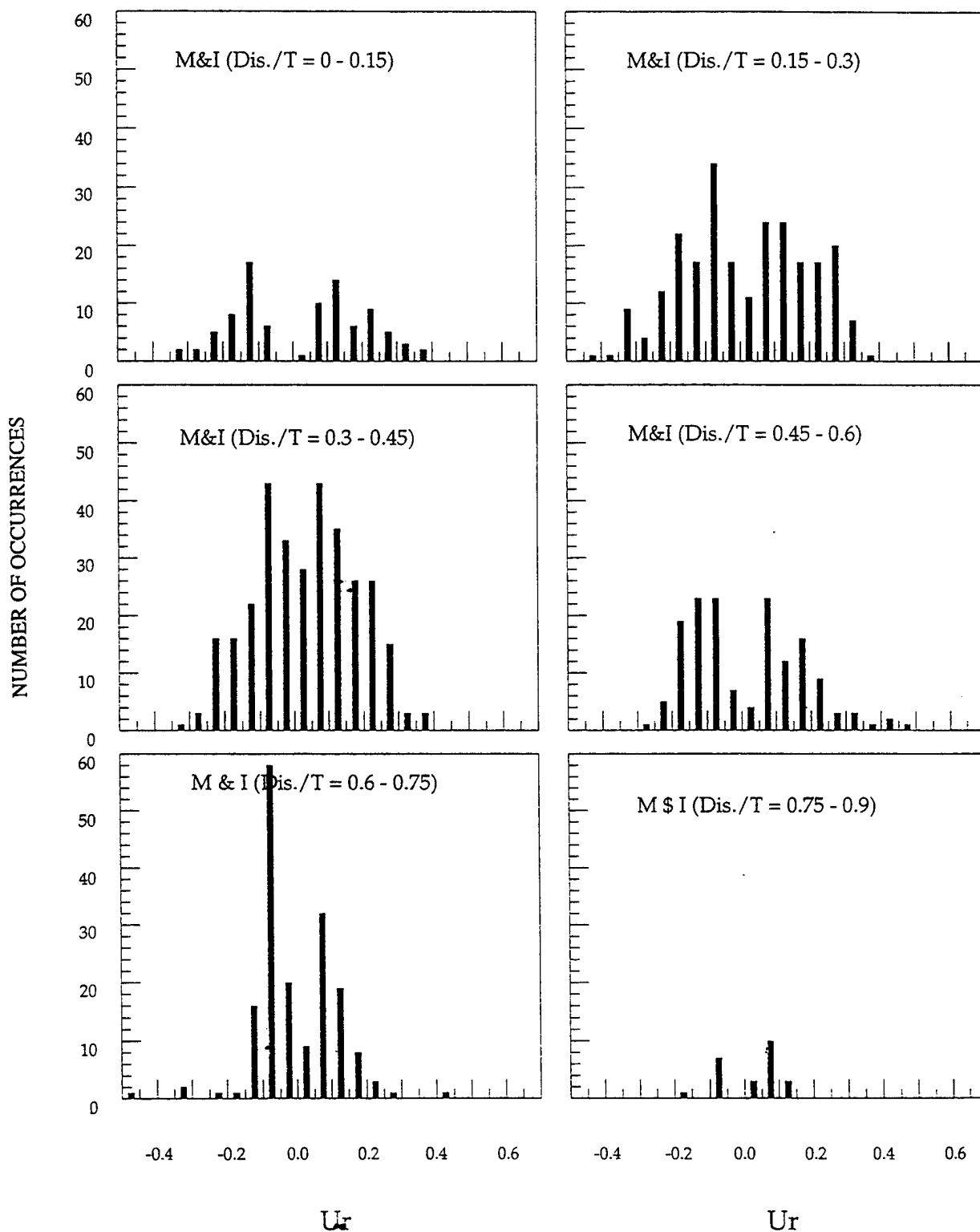
XXI-8. Histograms of $U_{r(max)}$ within various zones, Clarks Ferry, trip 2
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



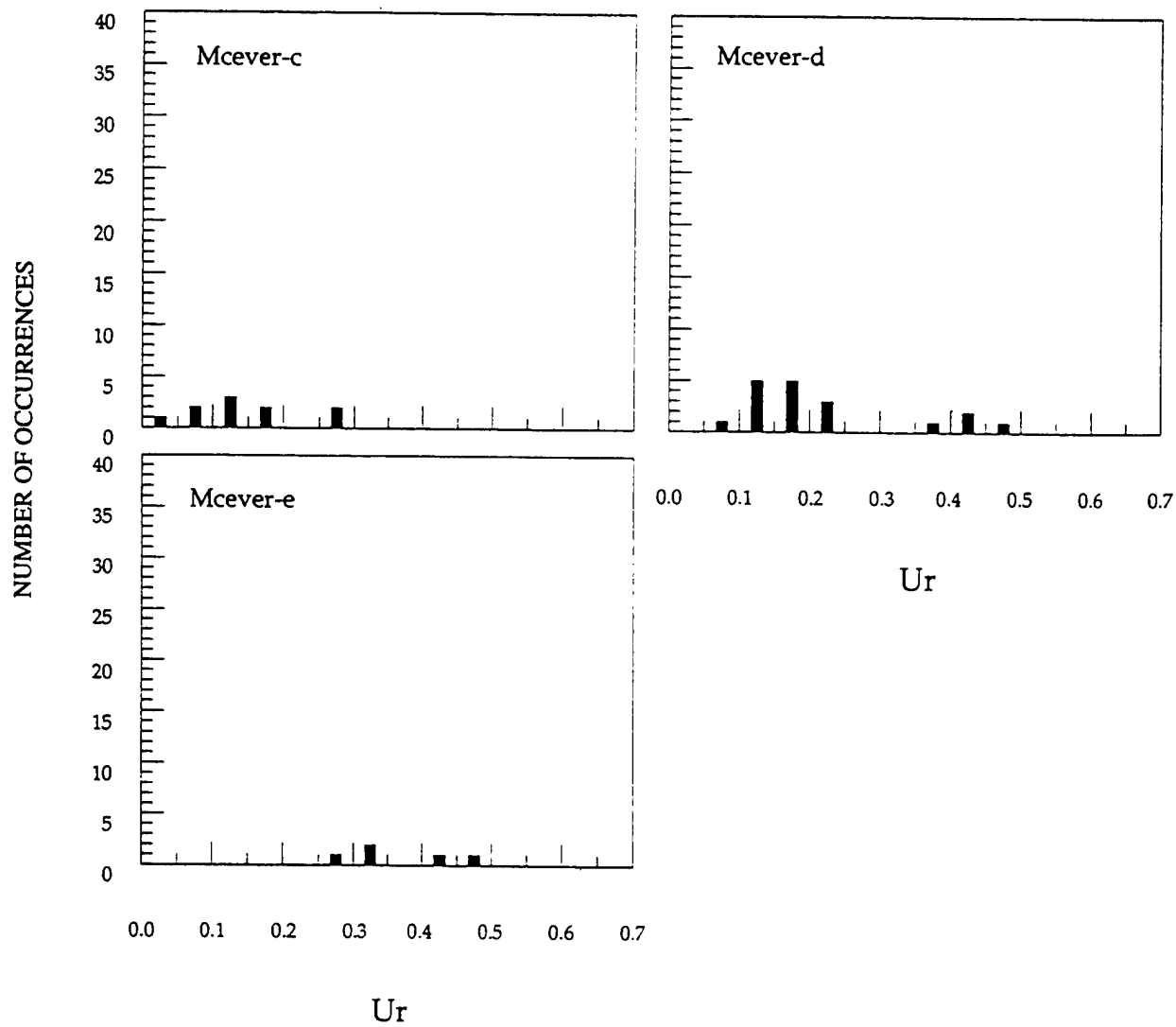
XXI-9. Histograms of $U_{r(max)}$ within various zones, Illinois River
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



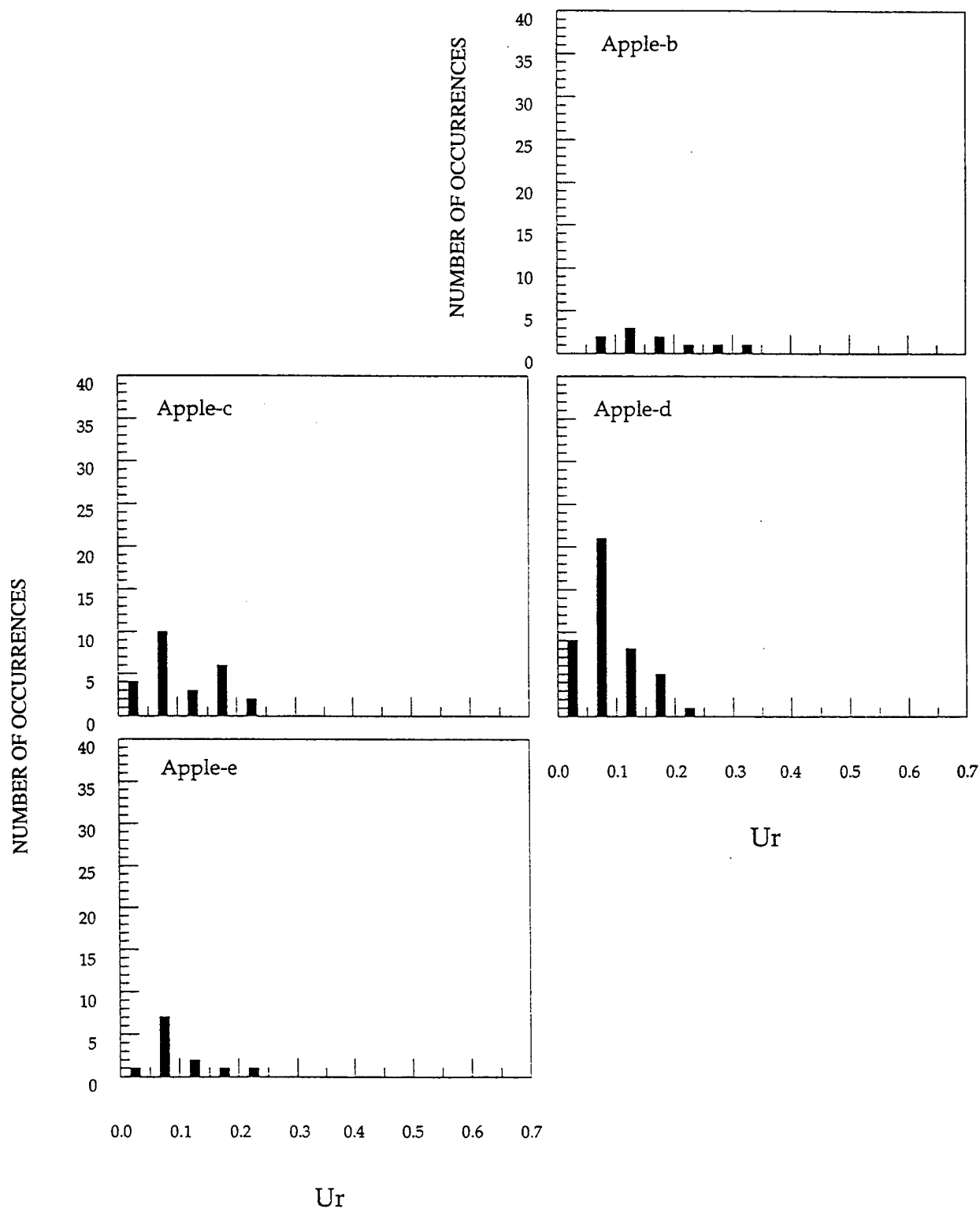
XXI-10. Histograms of $U_{r(max)}$ within various zones, Mississippi River
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



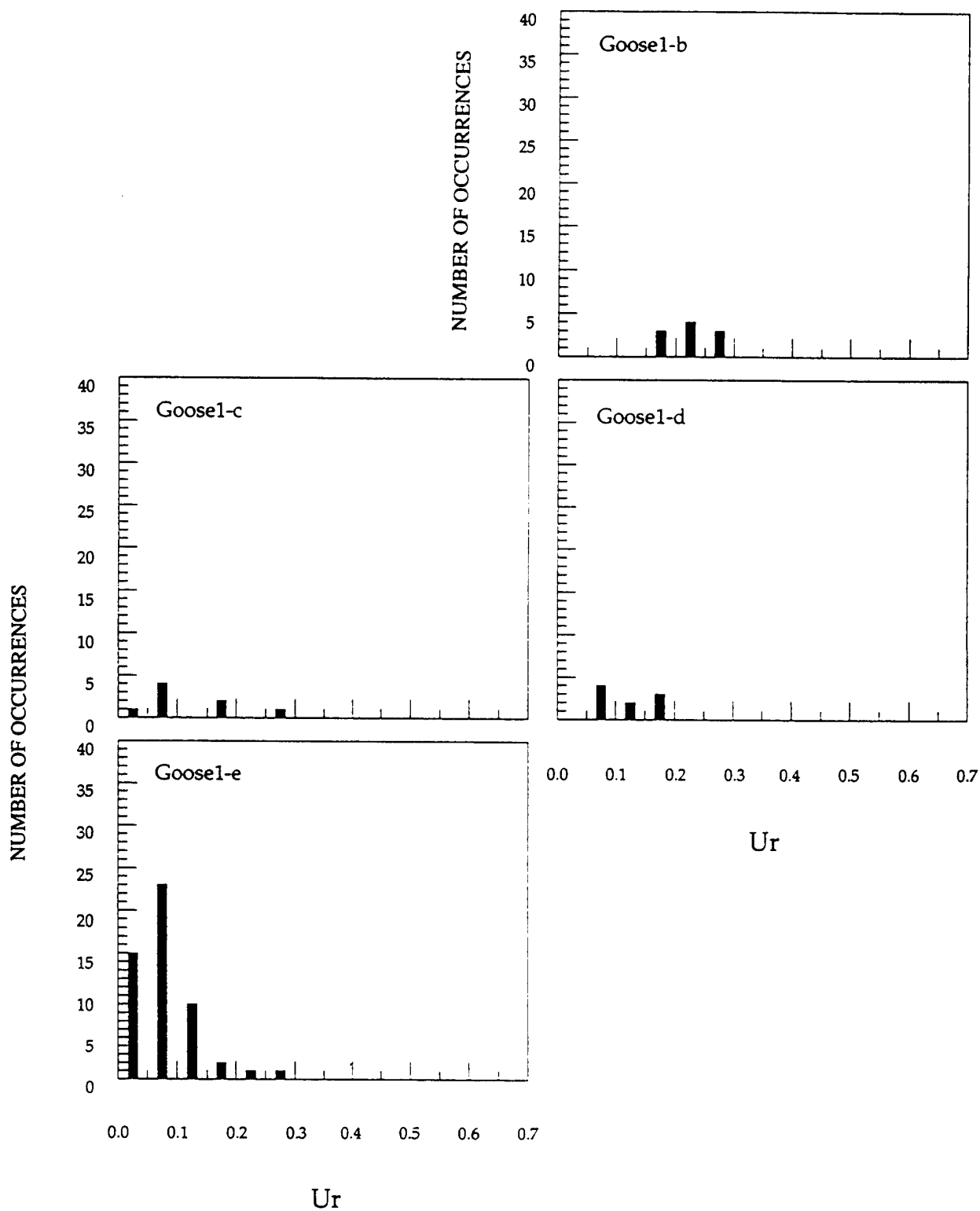
XXI-11. Histograms of $U_{r(max)}$ within various zones, Illinois and Mississippi Rivers
 ($U_{r(max)}$ carries signs to indicate an upstream- or downstream-bound barge effect)



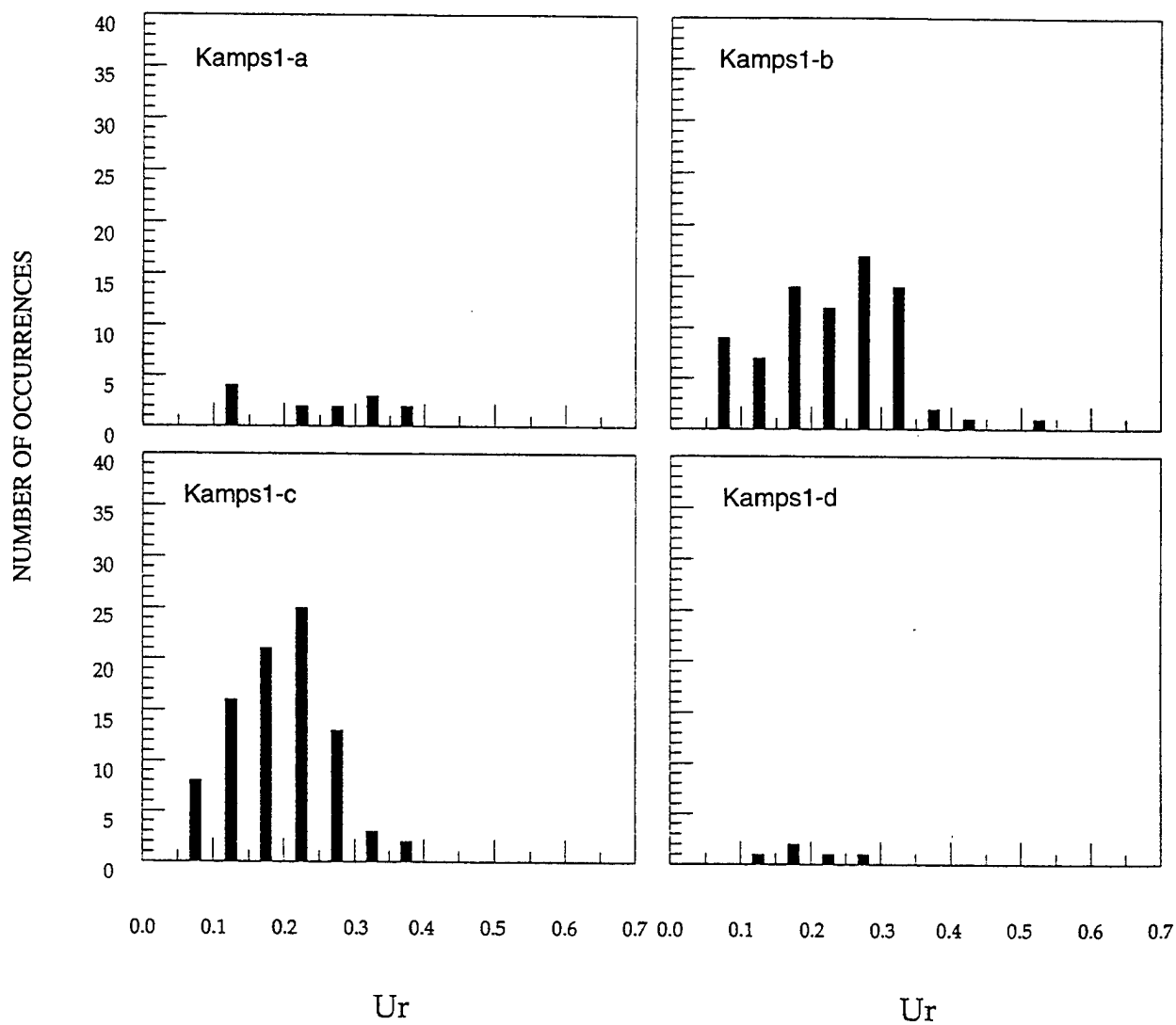
XXI-12. Histograms of absolute $U_{r(max)}$ within various zones, McEver's Island



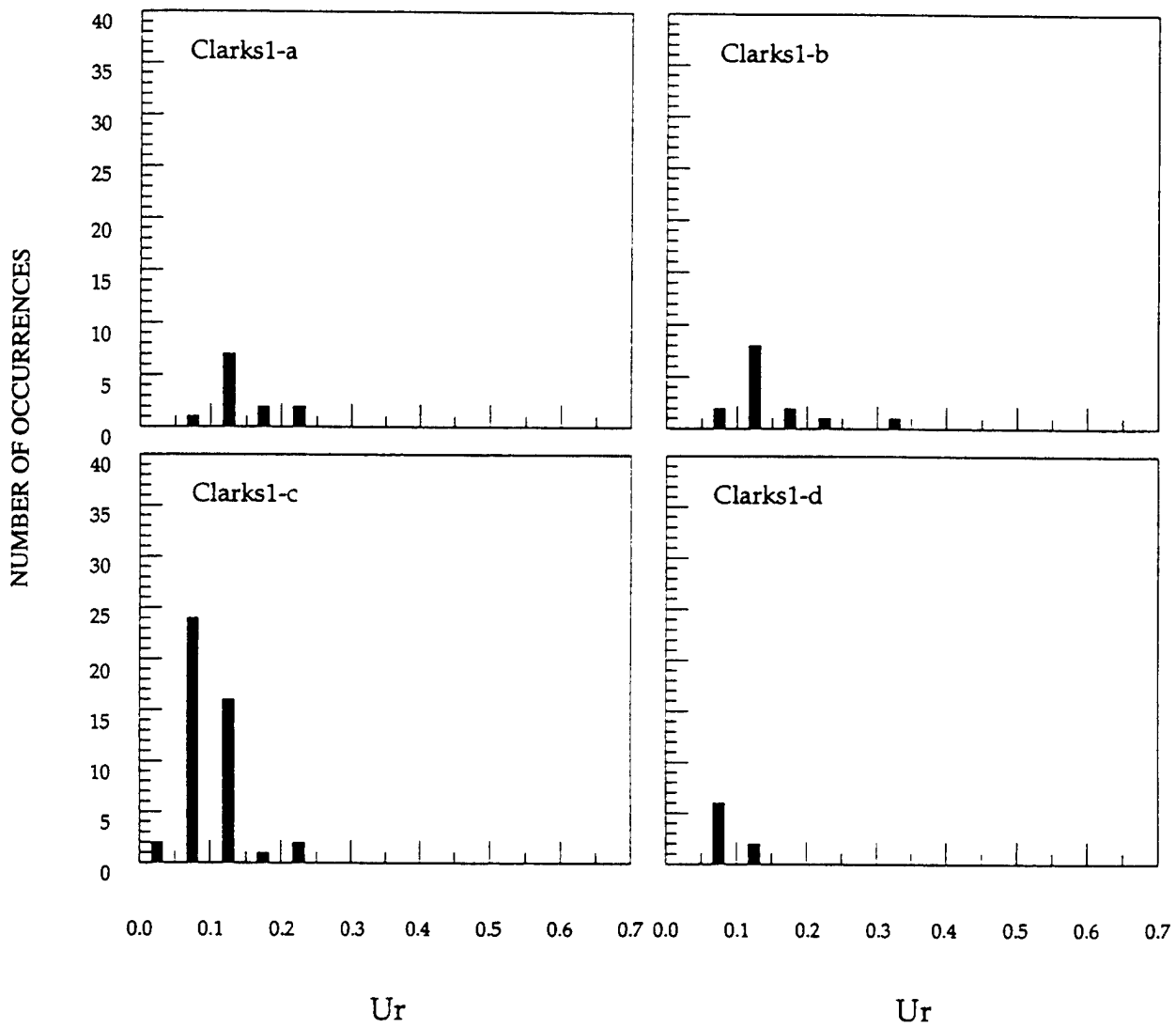
XXI-13. Histograms of absolute $U_{r(max)}$ within various zones, Apple River Island



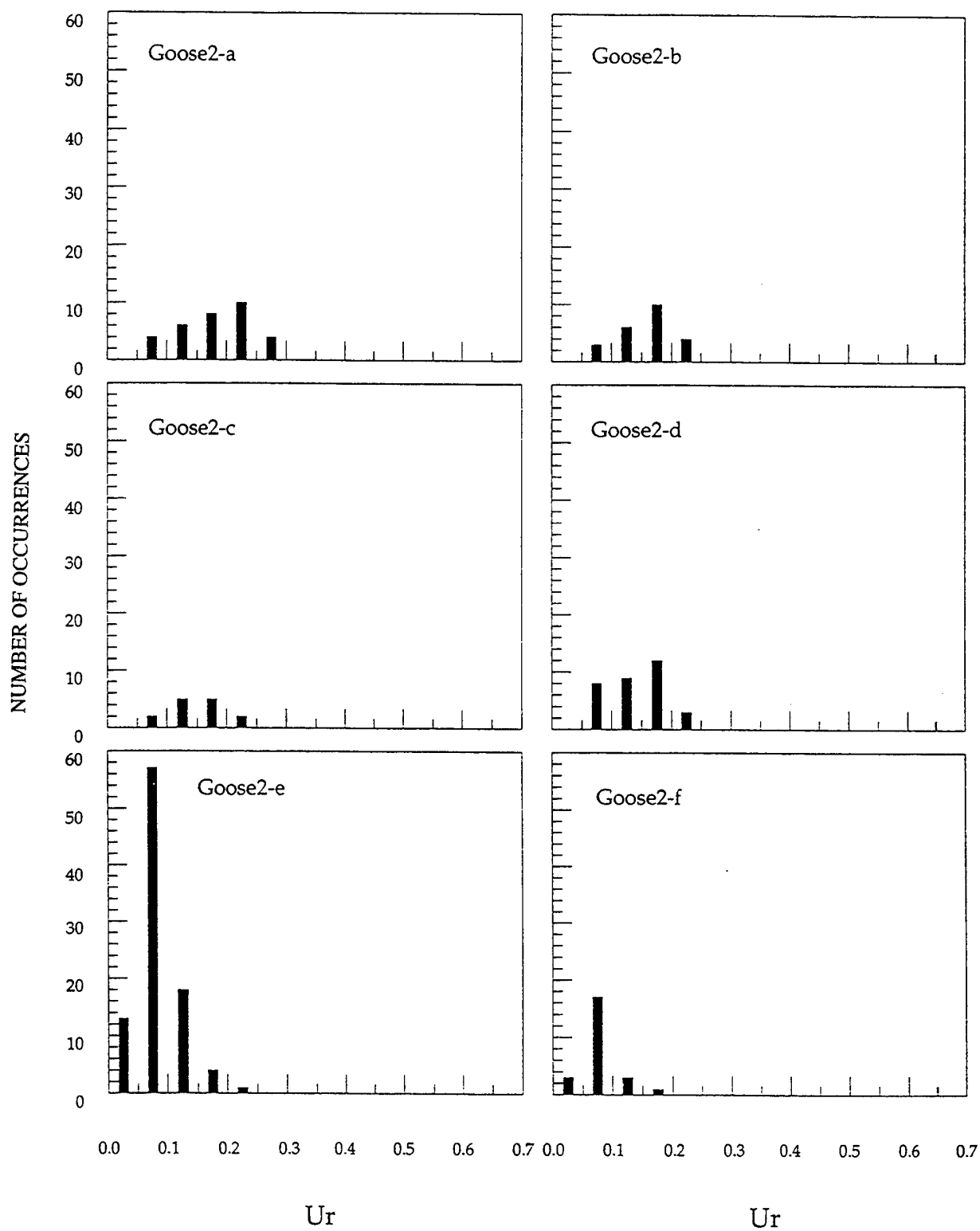
XXI-14. Histograms of absolute $U_{r(max)}$ within various zones, Goose Island, trip 1



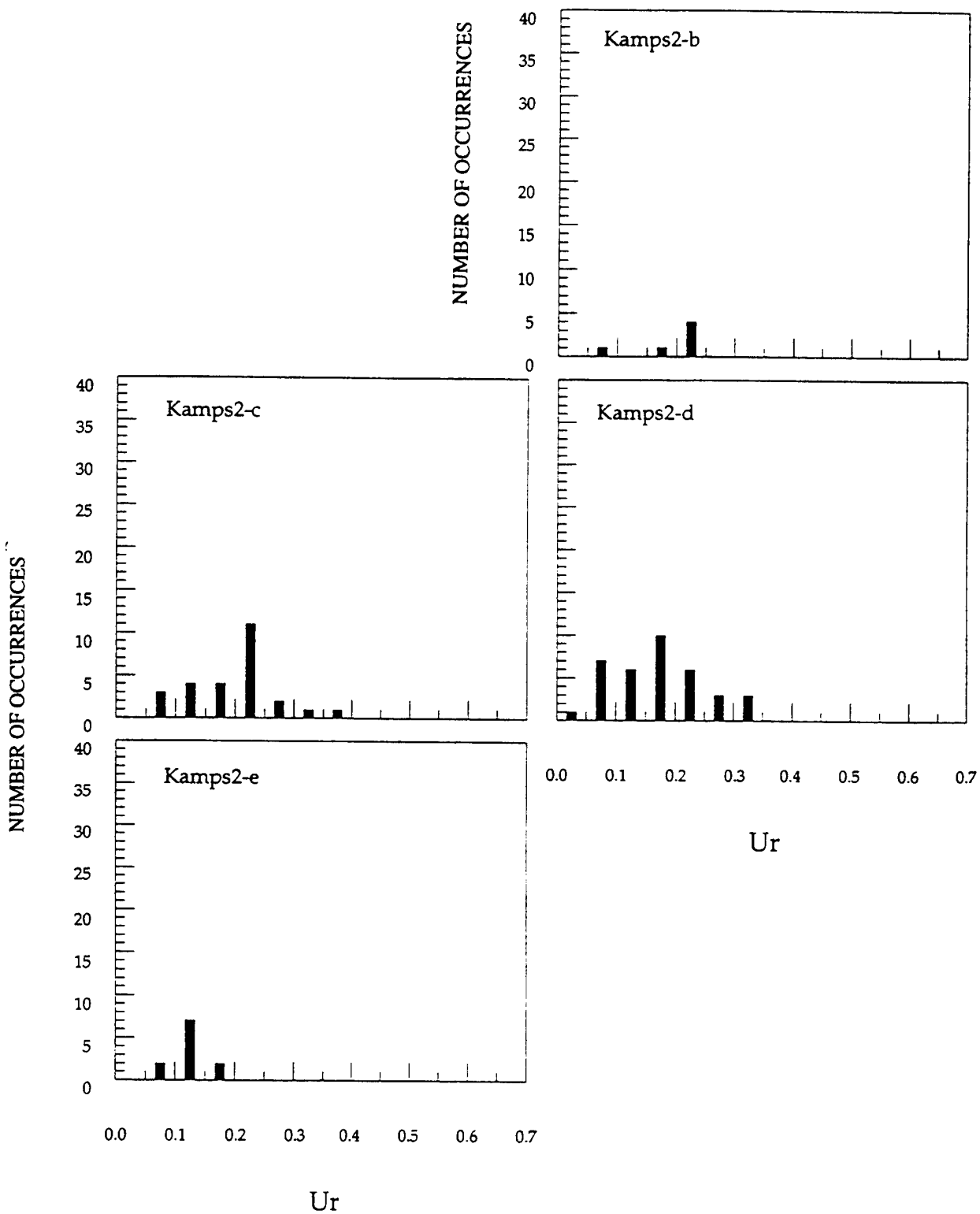
XXI-15. Histograms of absolute $U_{r(max)}$ within various zones, Kampsville, trip 1



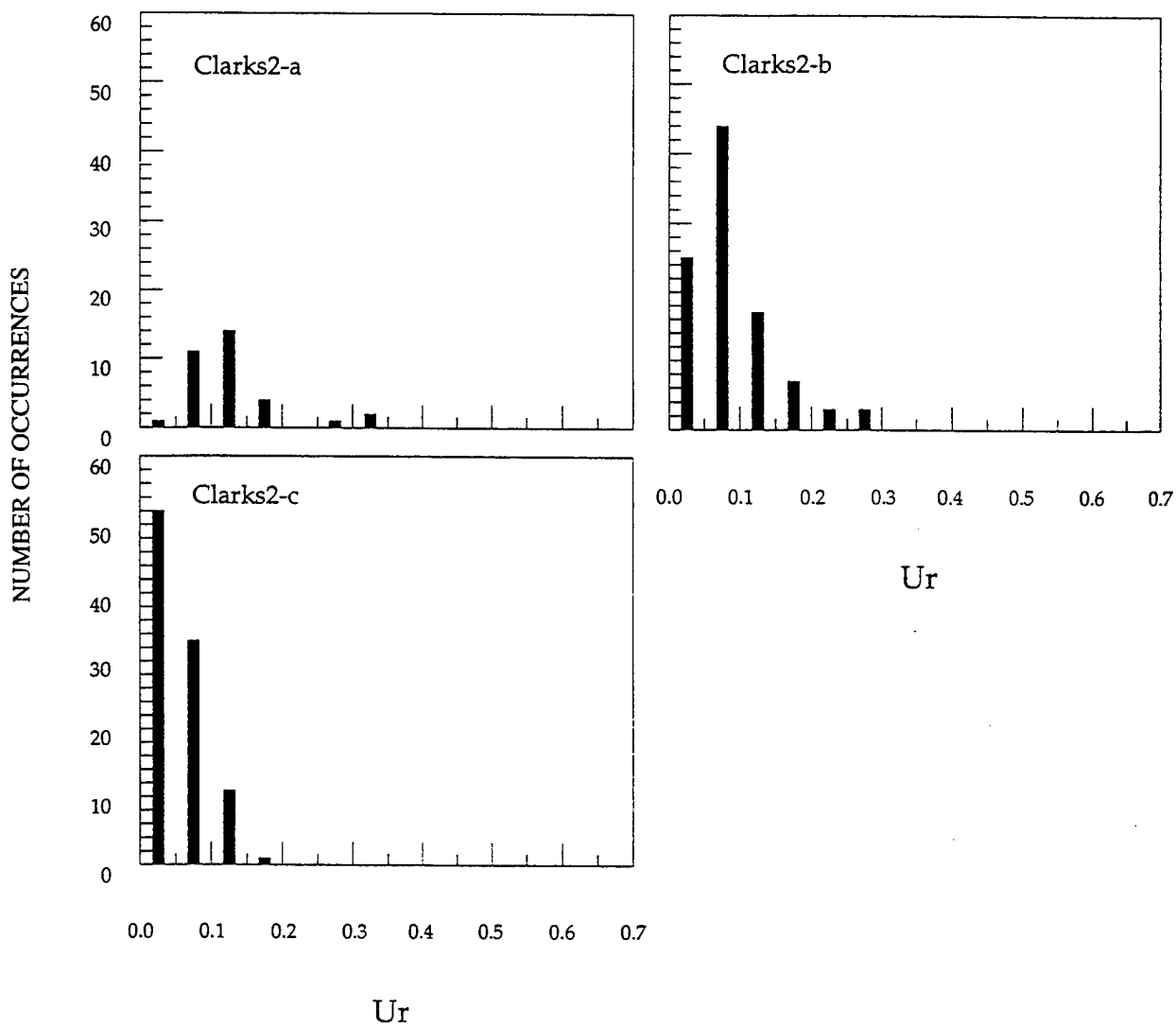
XXI-16. Histograms of absolute $U_{r(max)}$ within various zones, Clarks Ferry, trip 1



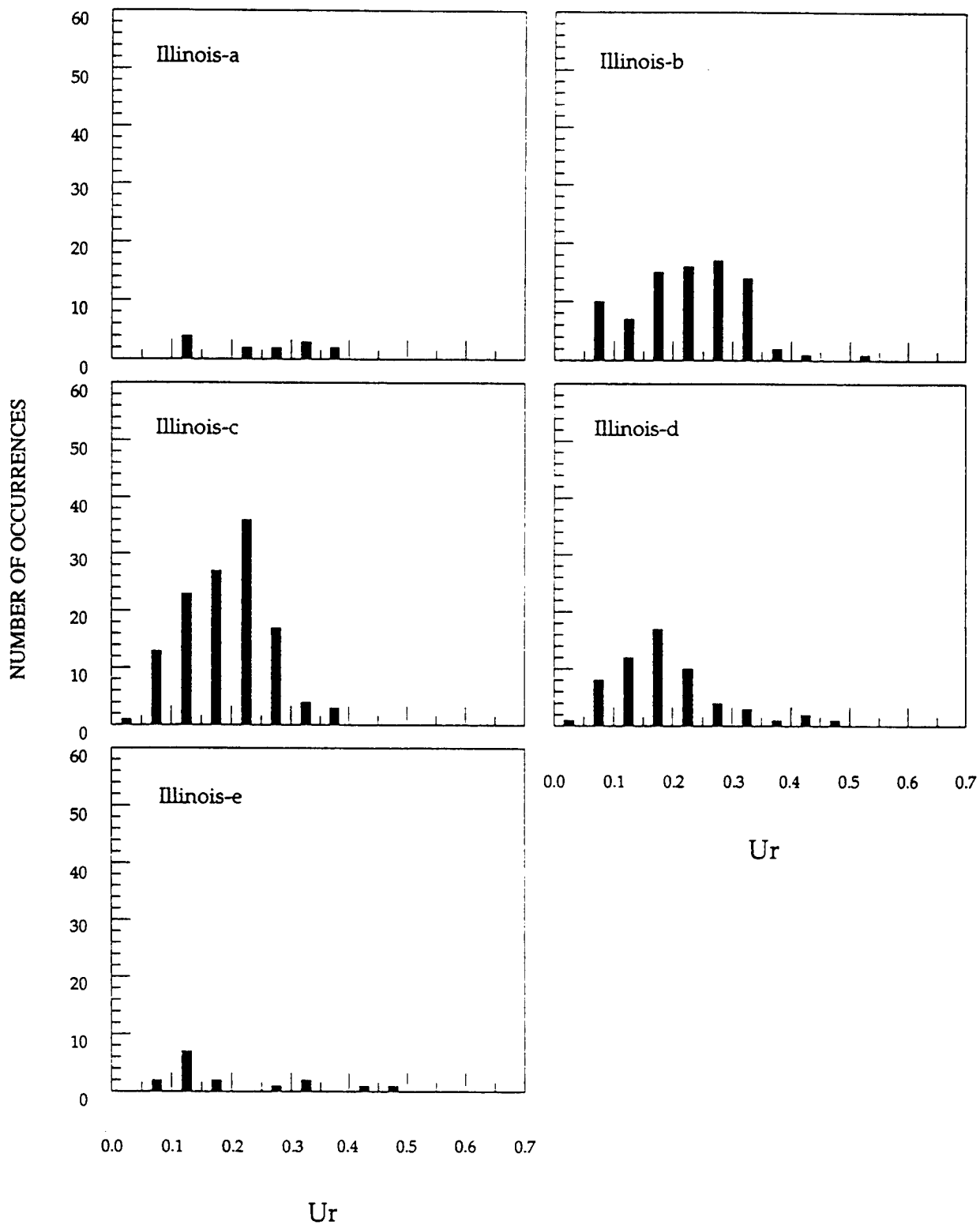
XXI-17. Histograms of absolute $U_{r(max)}$ within various zones, Goose Island, trip 2



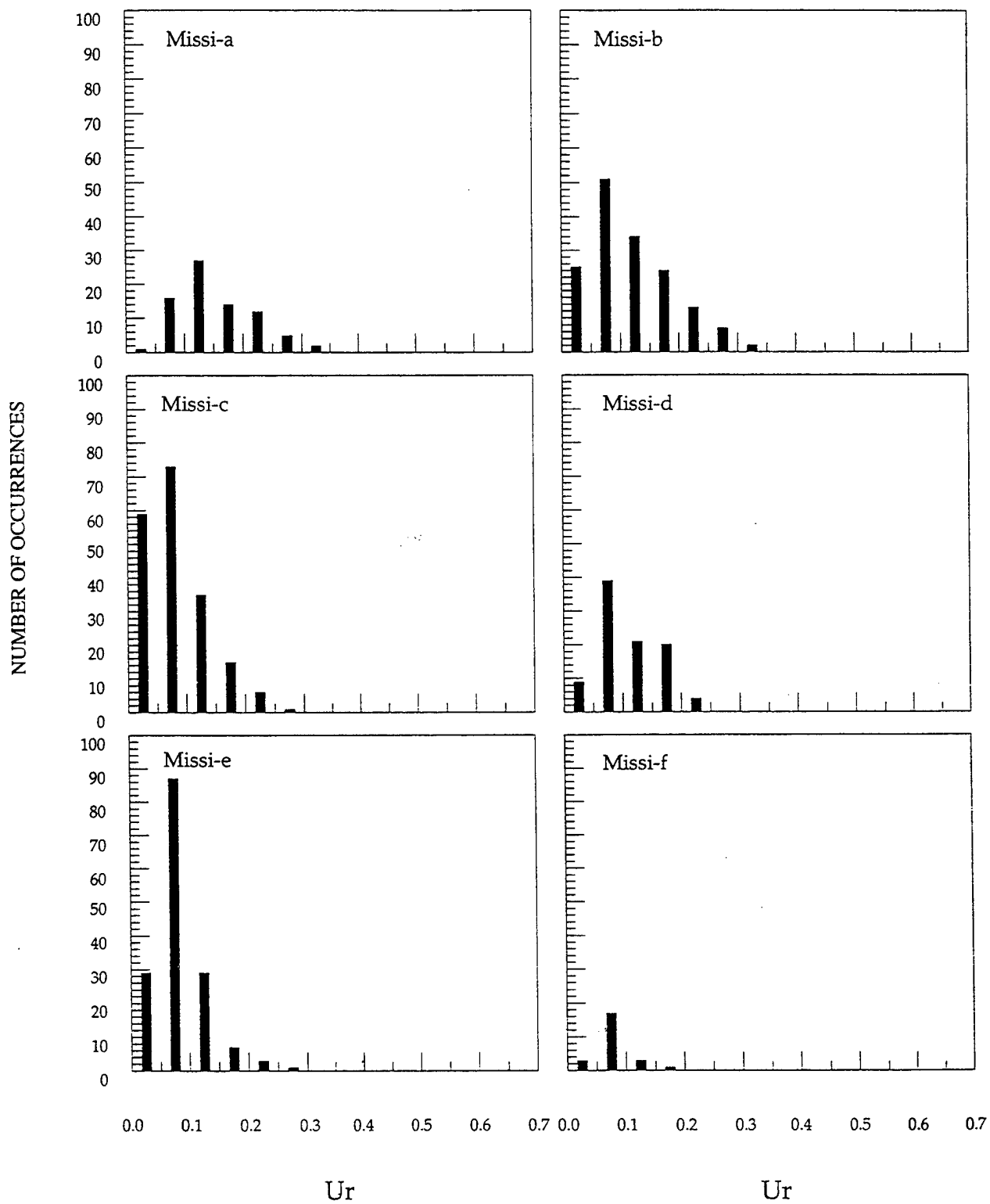
XXI-18. Histograms of absolute $U_{r(max)}$ within various zones, Kampsville, trip 2



XXI-19. Histograms of absolute $U_{r(max)}$ within various zones, Clarks Ferry, trip 2



XXI-20. Histograms of absolute $U_{r(max)}$ within various zones, Illinois River



XXI-21. Histograms of absolute $U_{r(max)}$ within various zones, Mississippi River

APPENDIX XXII.

**SAMPLE PLOTS OF WAVES AND DRAWDOWN GENERATED
BY NAVIGATION TRAFFIC**

Jeff Boat

MEAN = 1.29

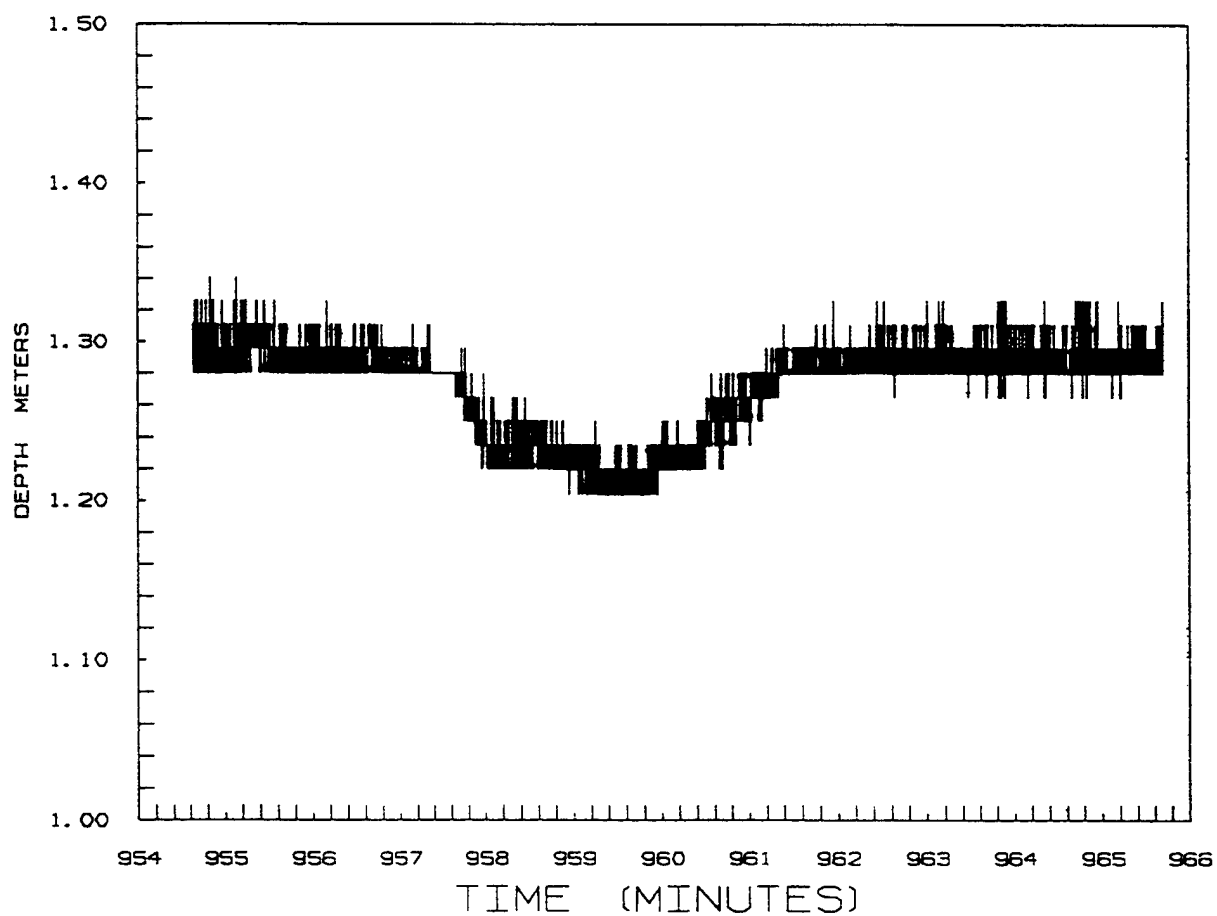
At: Kampsville (1)

VMAX = 1.34 TMAX = 954.84

date:10/14/90

VMIN = 1.20 TMIN = 958.95

time:15:57



XXII-1. Measured drawdown and waves for barge *Jeff Boat* at Kampsville, trip 1

Irving Crown

MEAN = 0.99

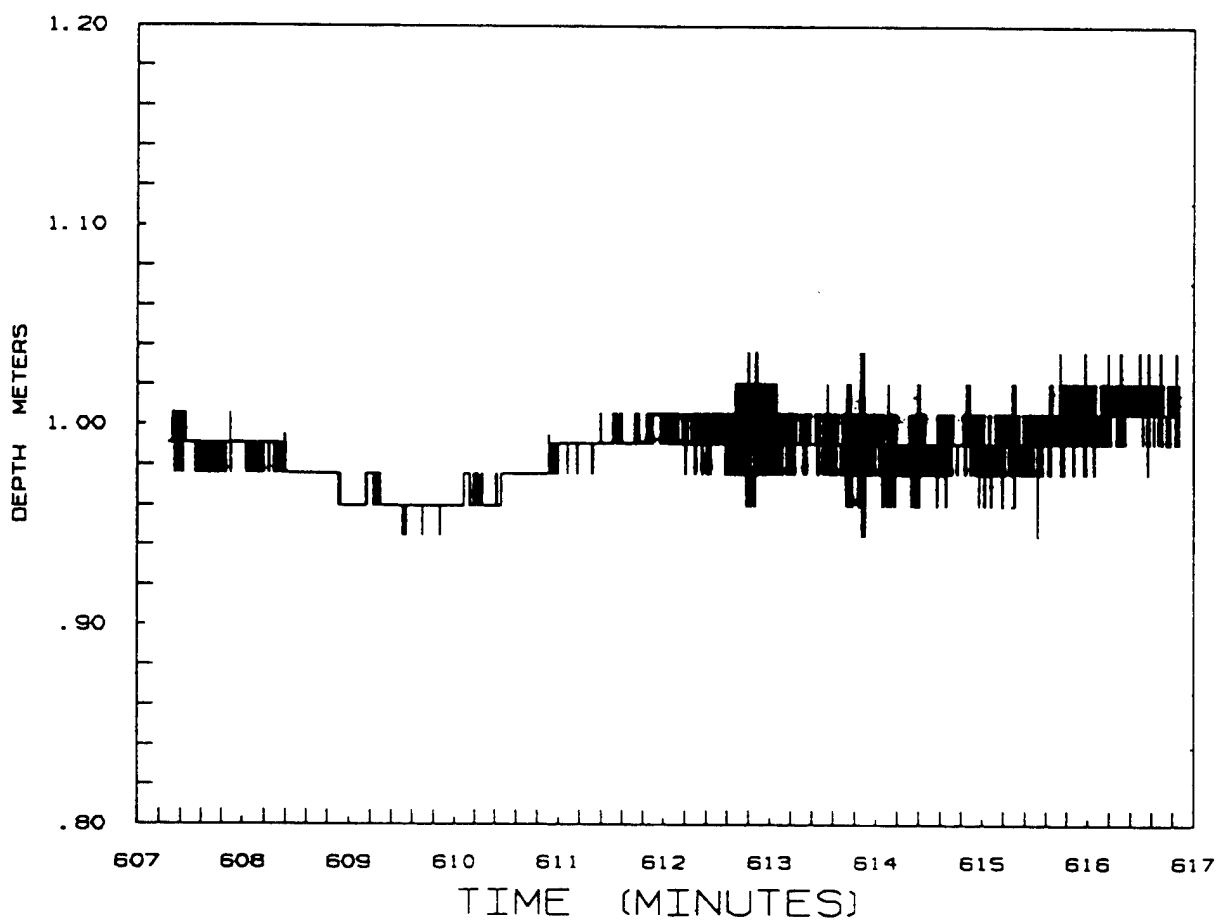
At: Kampsville (2)

VMAX = 1.04 TMAX = 612.79

date:8/14/91

VMIN = 0.95 TMIN = 609.50

time:10:08



XXII-2. Measured drawdown and waves for barge *Irving Crown* at Kampsville, trip 2

American Beauty

MEAN = 0.94

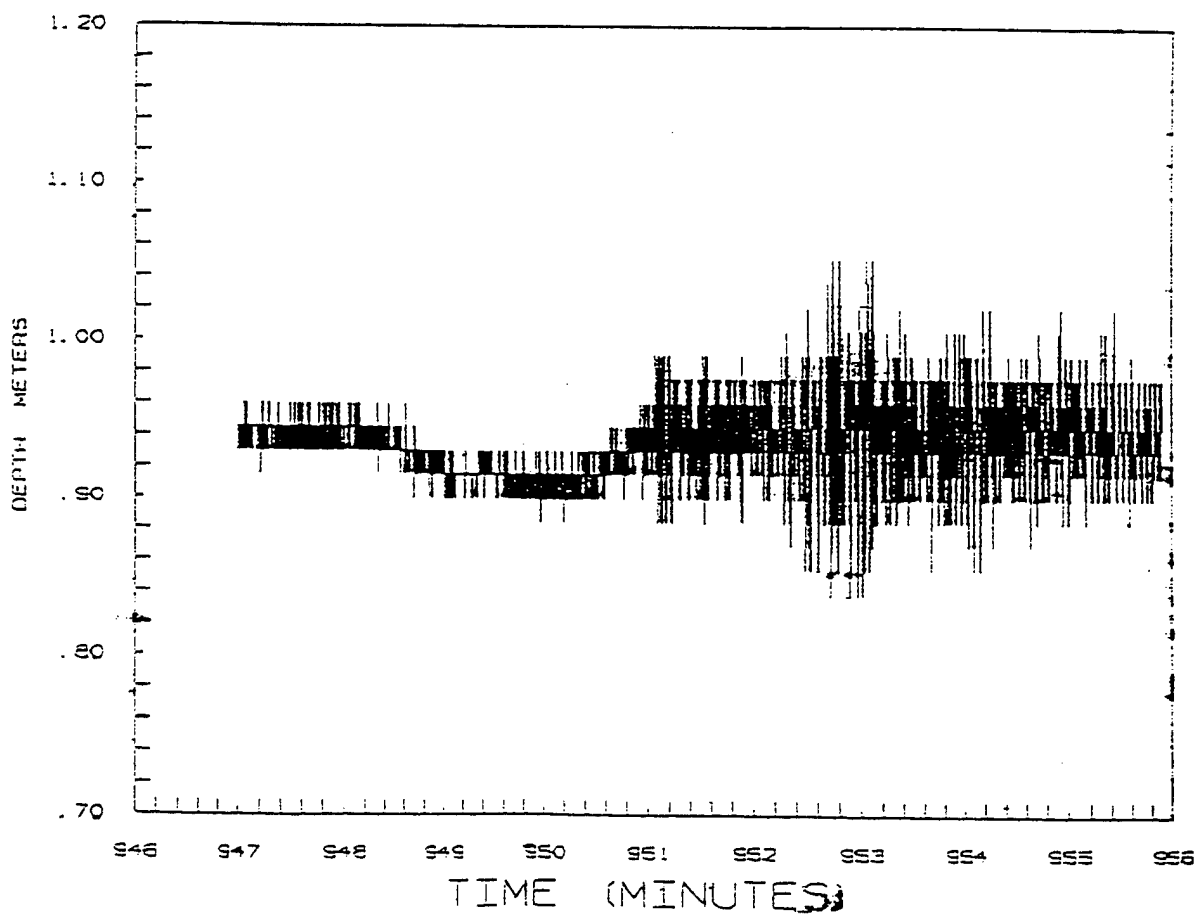
At: Clarks Ferry (1)

VMAX = 1.05 TMAX = 952.73

date:05/20/91

VMIN = 0.84 TMIN = 952.71

time:15:48:23



XXII-3. Measured drawdown and waves for barge *American Beauty* at Clarks Ferry, trip 1

Hugh C. Blaske

MEAN = 0.74

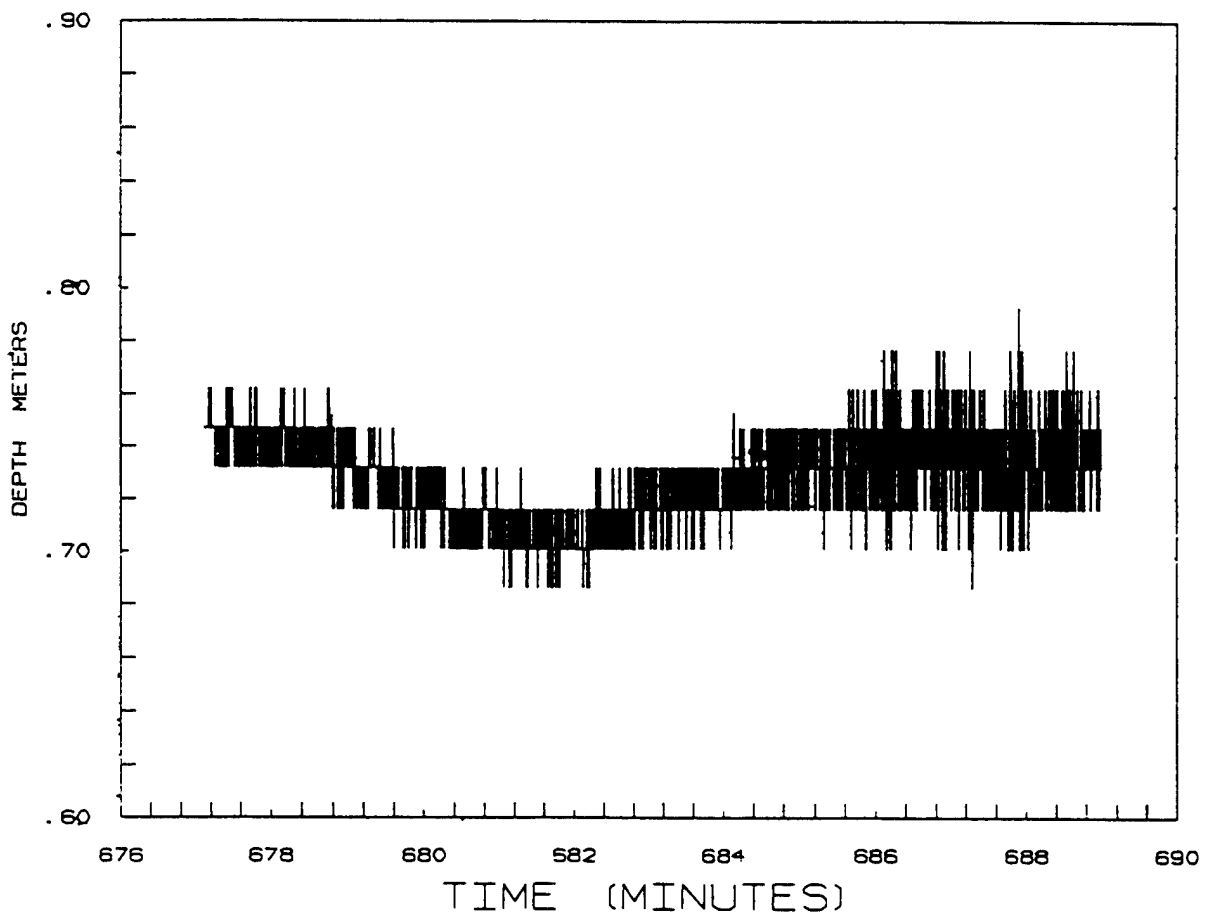
At: Goose Island

VMAX = 0.79 TMAX = 687.90

date:08/25/90

VMIN = 0.69 TMIN = 681.06

time:11:19



XXII-4. Measured drawdown and waves for barge *Hugh C. Blaske* at Goose Island, trip 1

James F. Neal

MEAN = 0.63

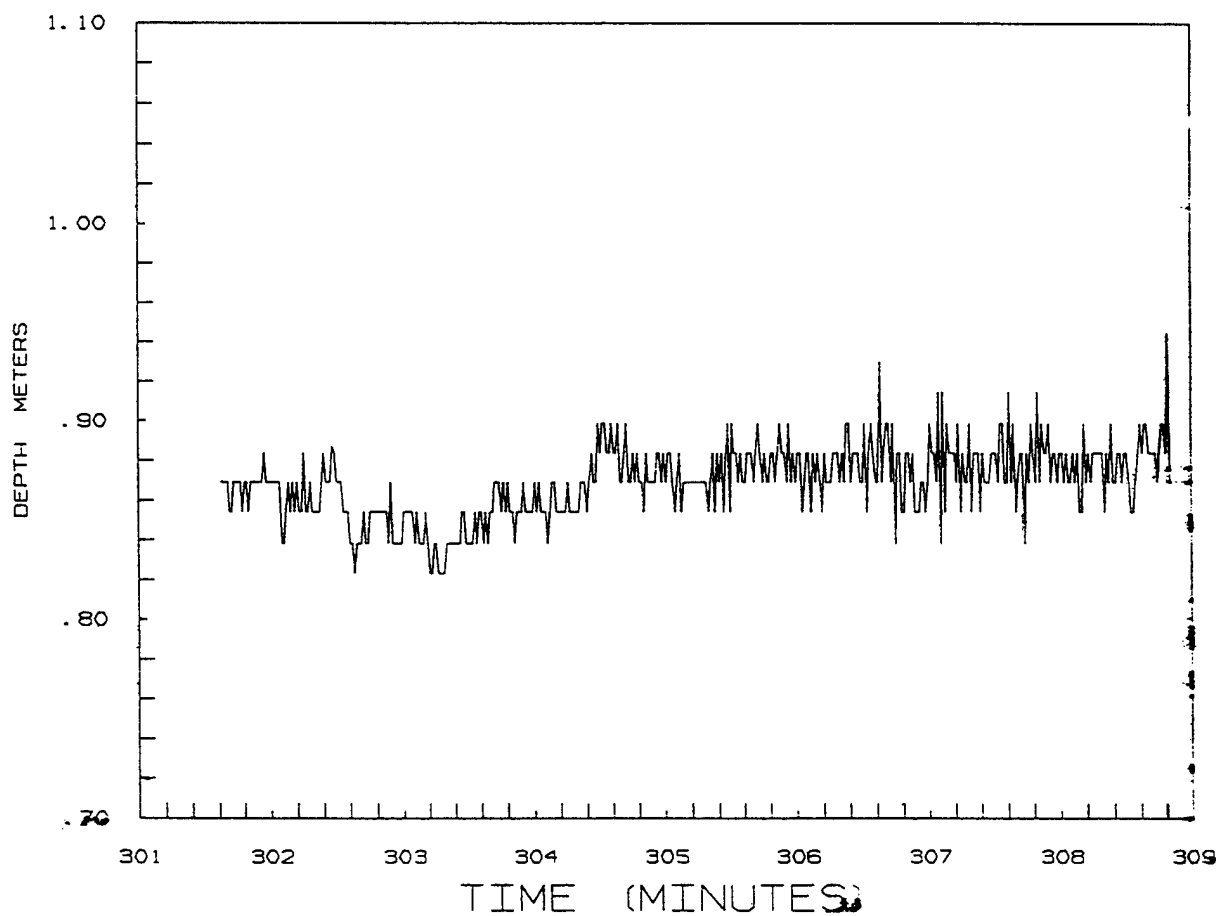
At: Goose Island

VMAX = 0.95 TMAX = 308.81

date:07/18/91

VMIN = 0.82 TMIN = 302.64

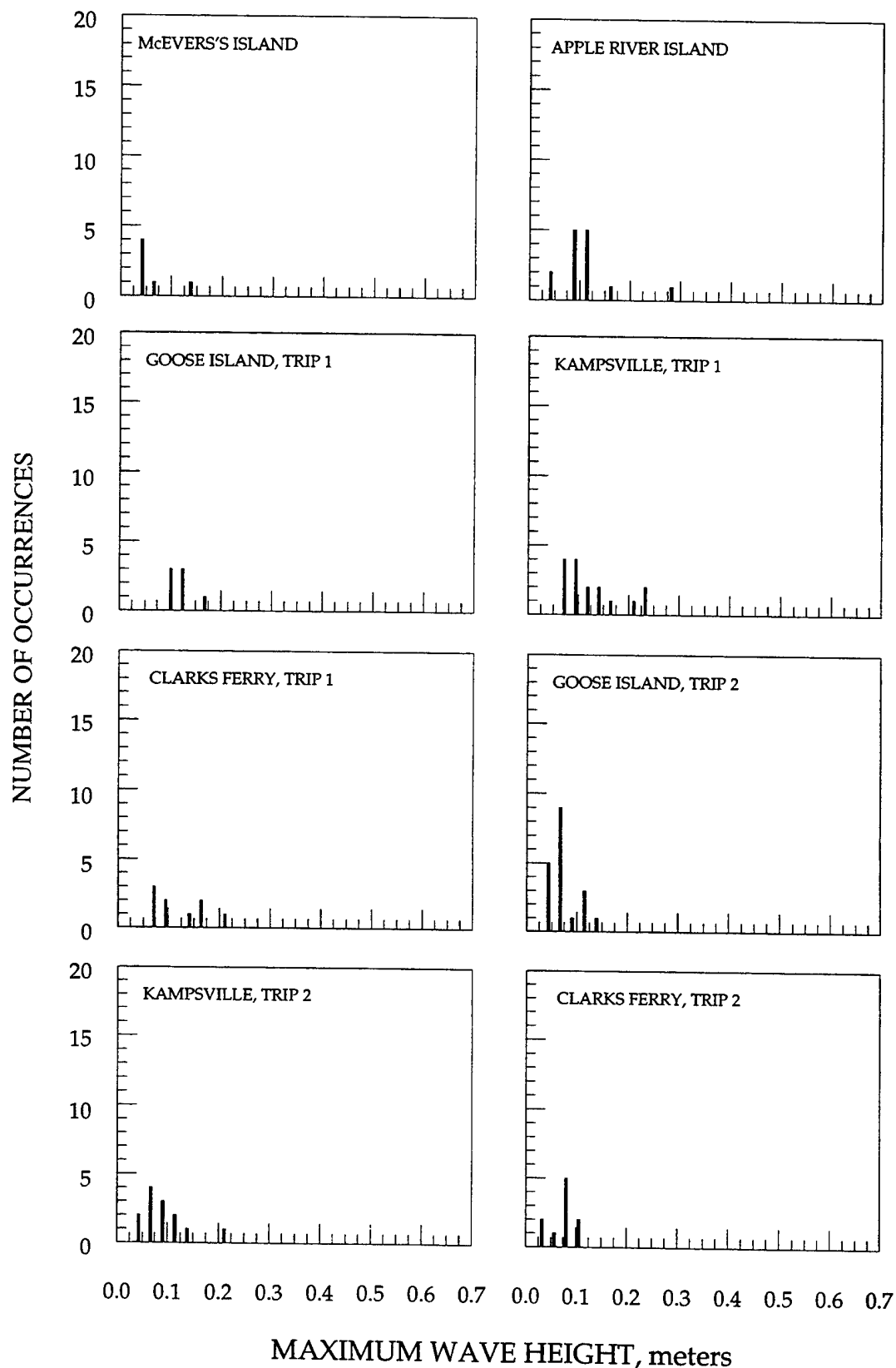
time:14:17



XXII-5. Measured drawdown and waves for barge *James F. Neal* at Goose Island, trip 2

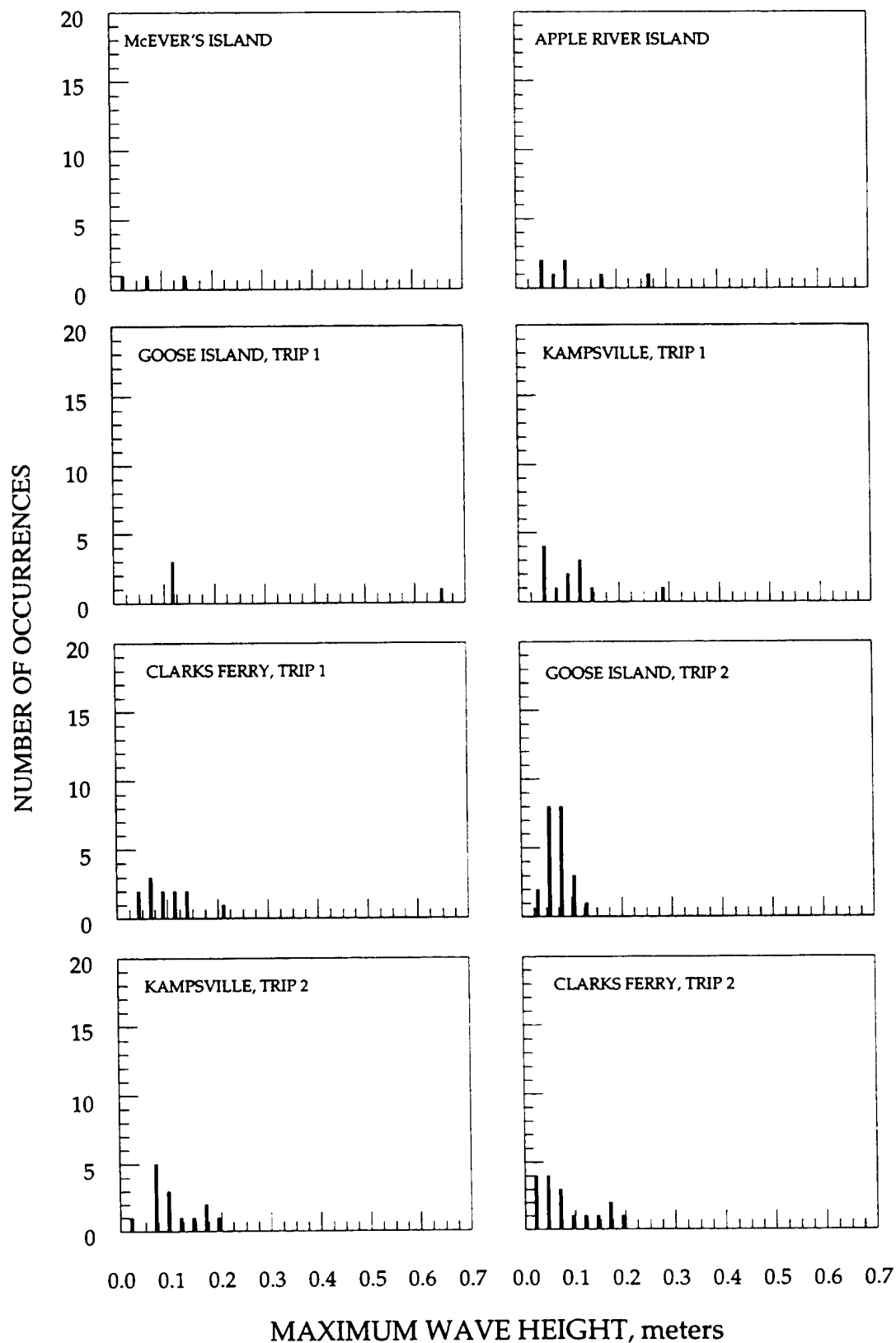
APPENDIX XXIII.
HISTOGRAMS OF MAXIMUM WAVE HEIGHT

UPSTREAM BARGES



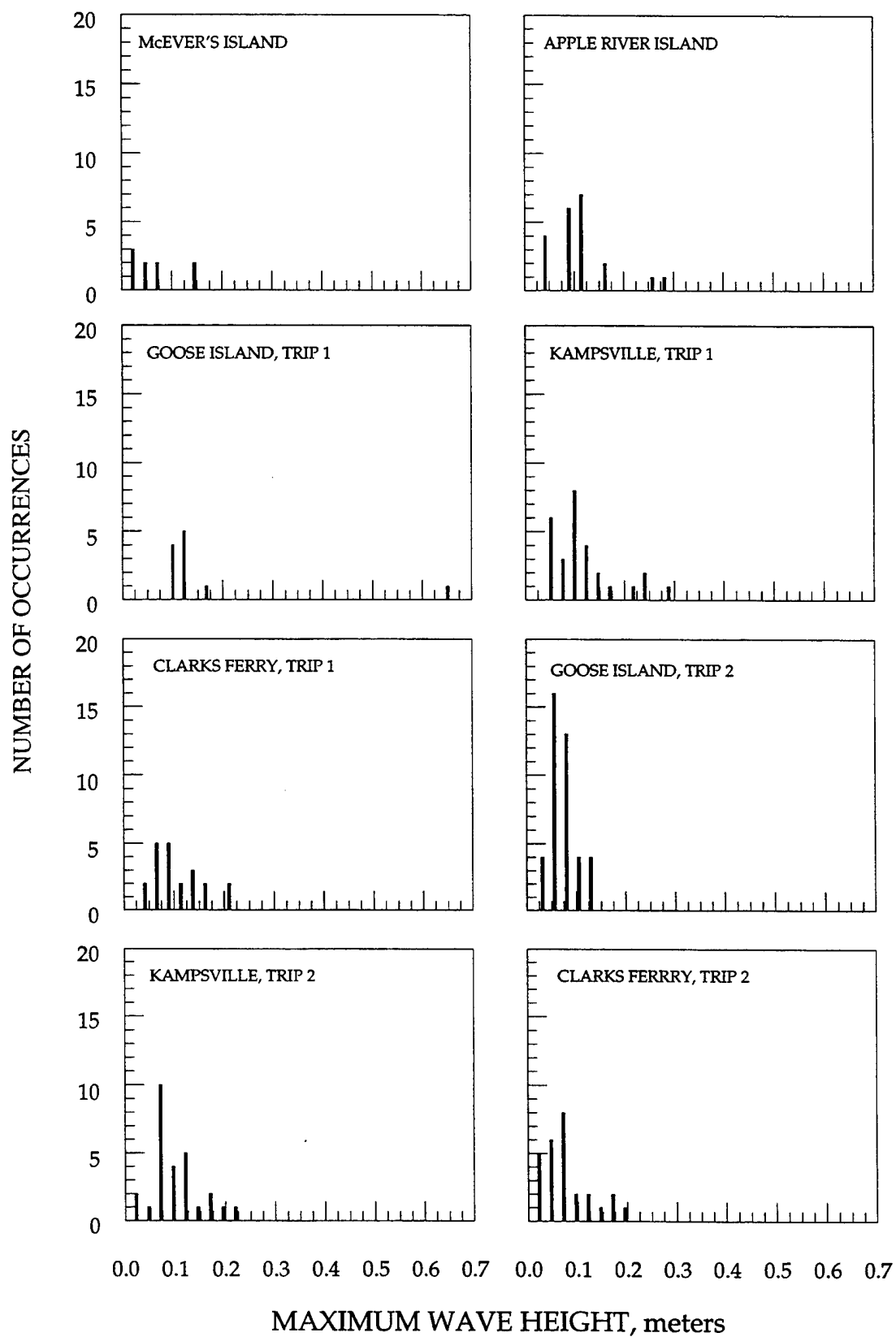
XXIII-1. Histograms of maximum wave height, upstream barges

DOWNSTREAM BARGES

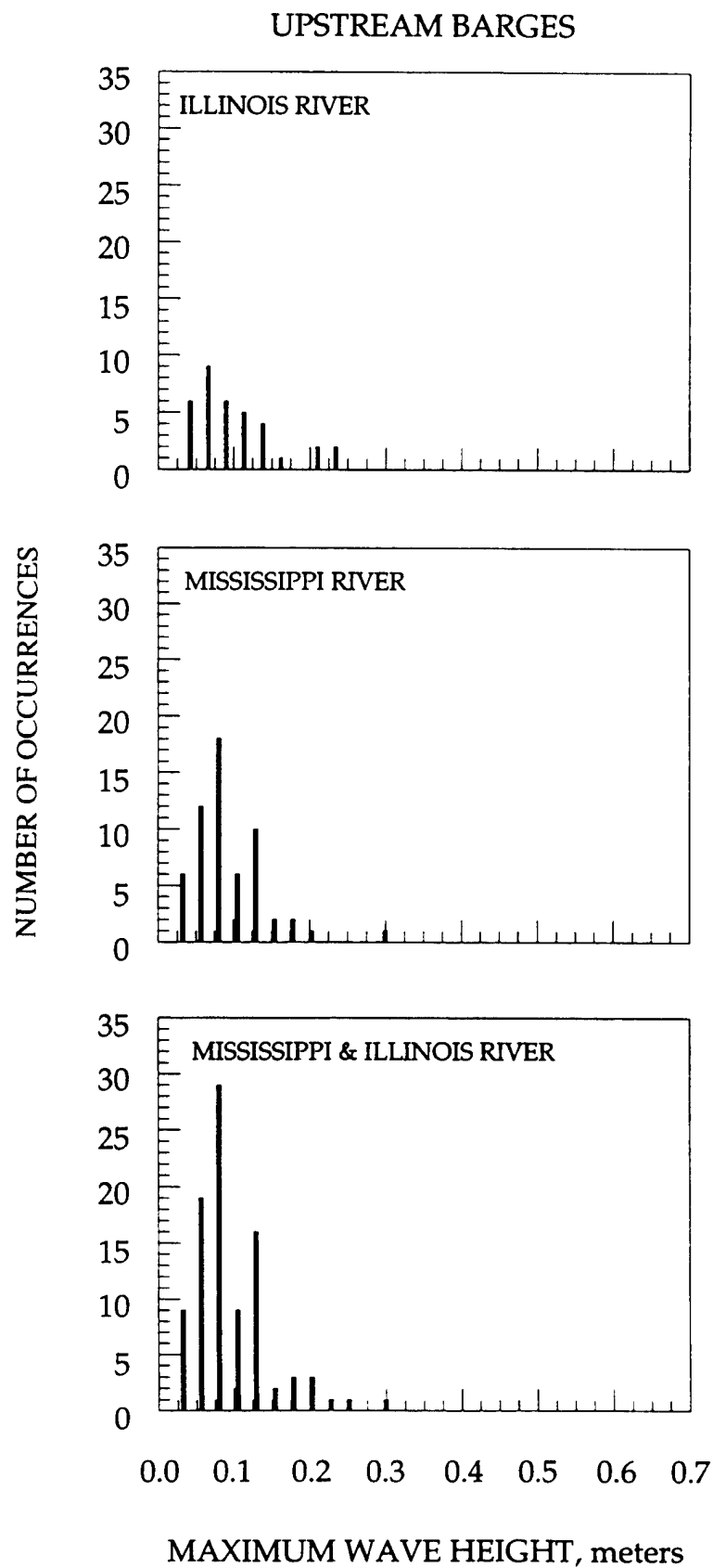


XXIII-2. Histograms of maximum wave height, downstream barges

ALL BARGES

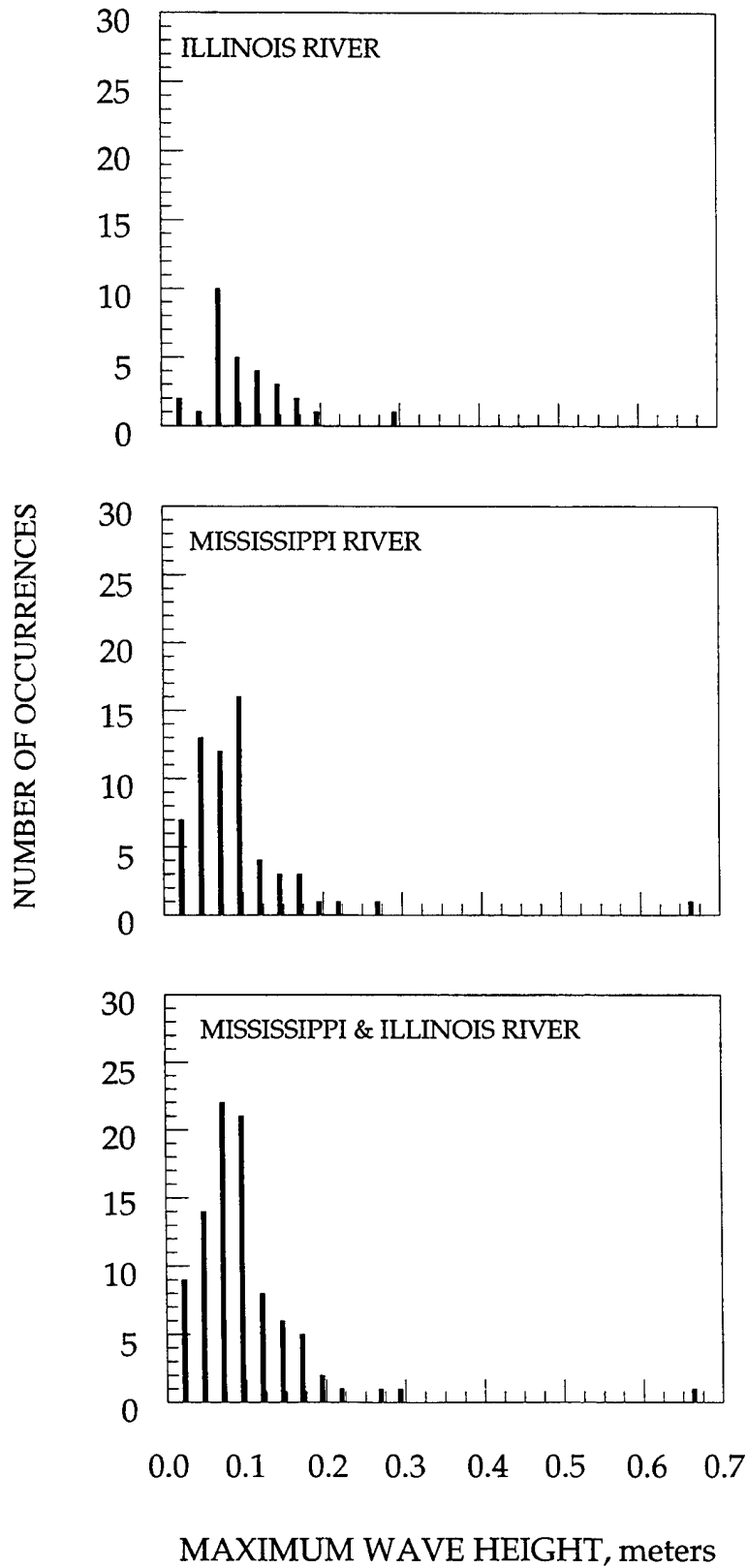


XXIII-3. Histograms of maximum wave height, all barges



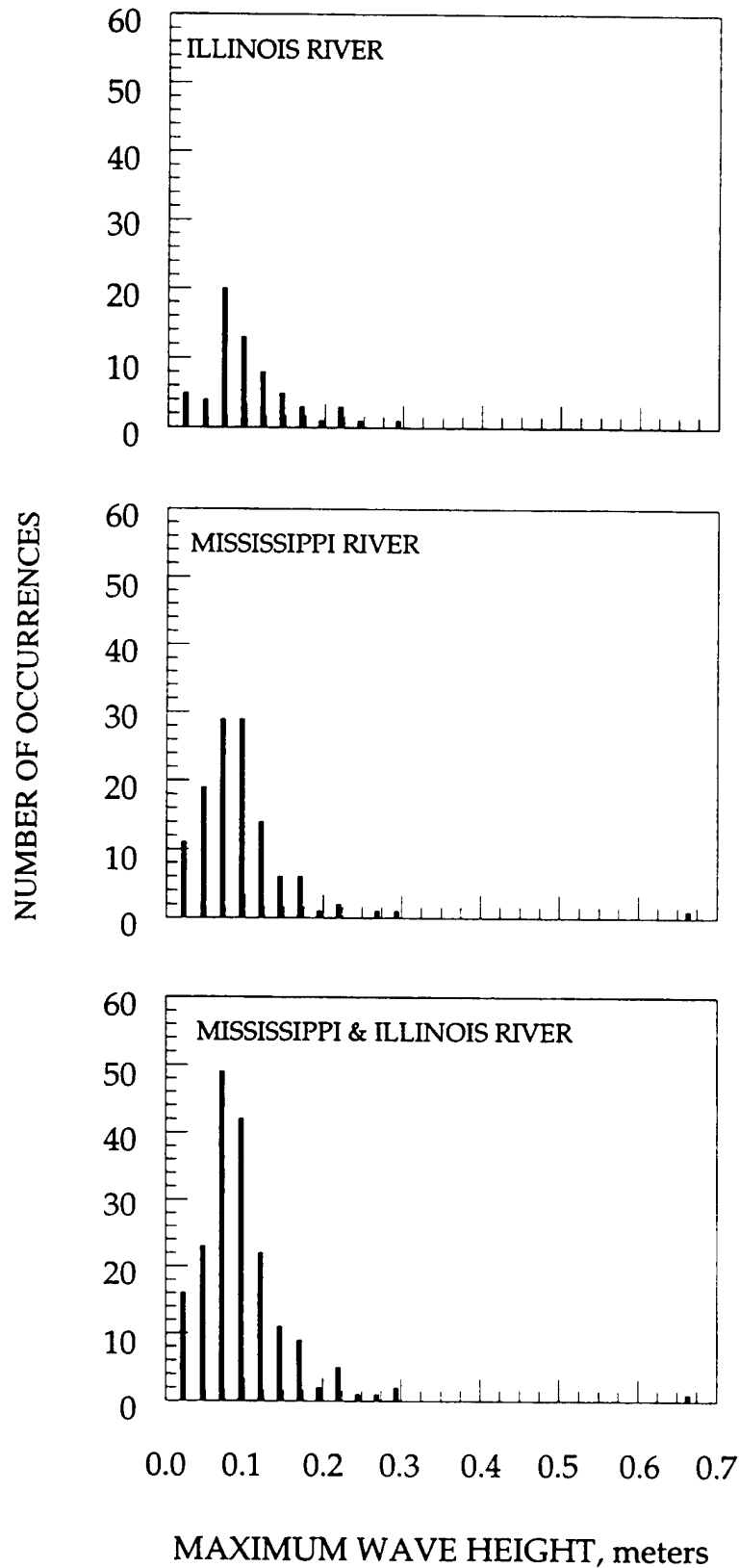
XXIII-4. Histograms of maximum wave height for the river system, upstream barges

DOWNSTREAM BARGES



XXIII-5. Histograms of maximum wave height for the river system, downstream barges

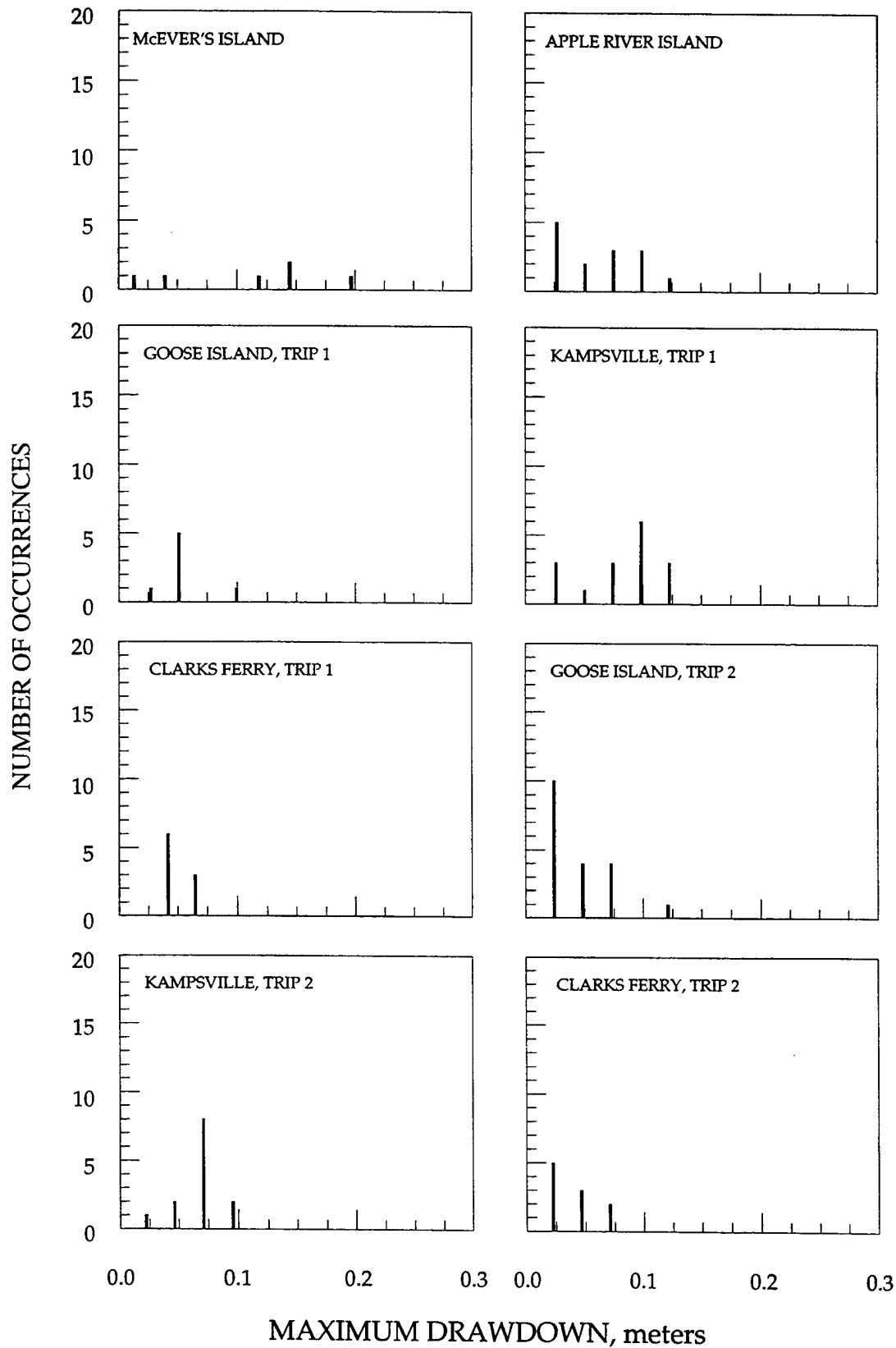
ALL BARGES



XXIII-6. Histograms of maximum wave height for the river system, all barges

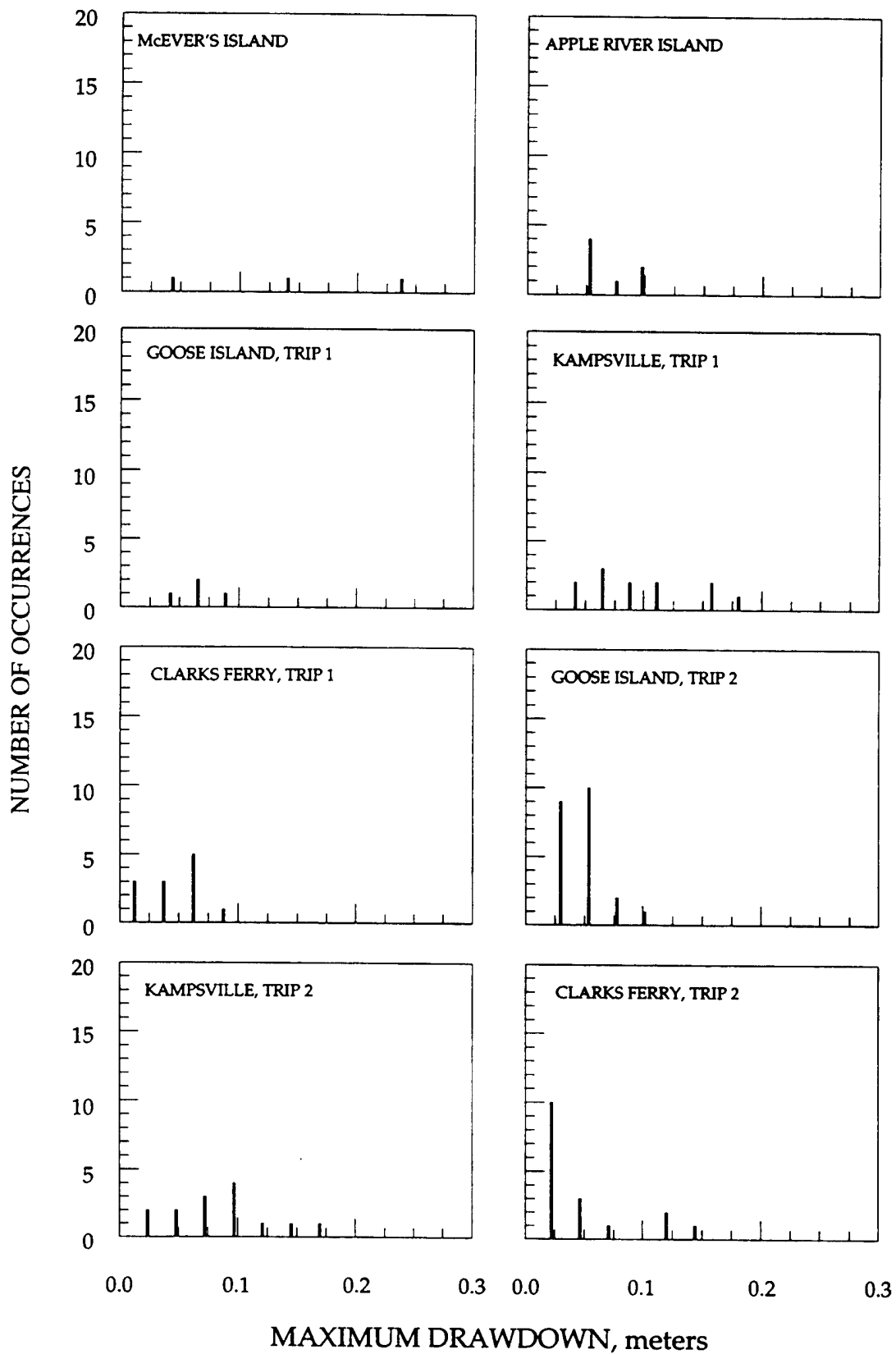
APPENDIX XXIV.
HISTOGRAMS OF MAXIMUM DRAWDOWN

UPSTREAM BARGES



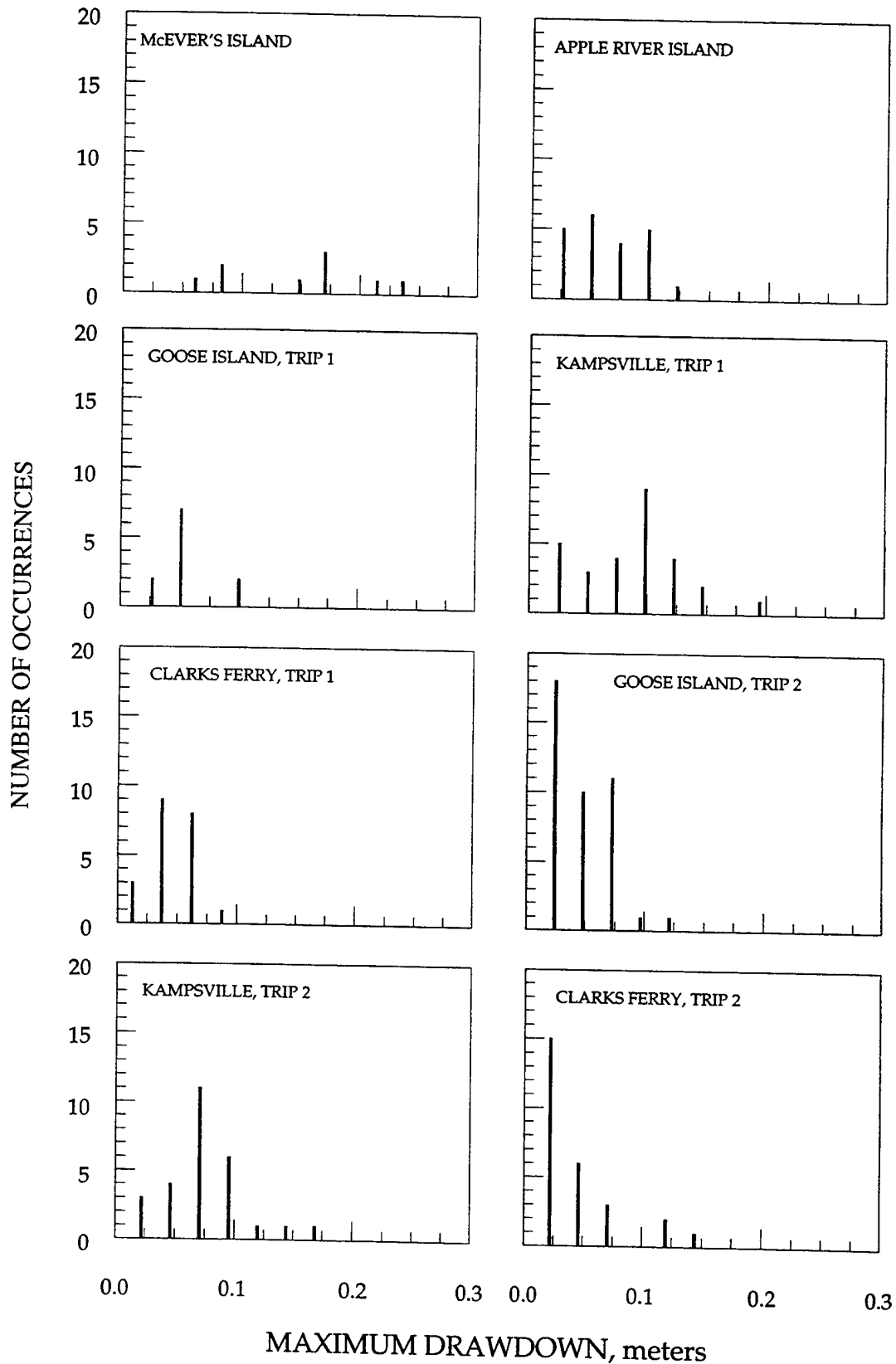
XXIV-1. Histograms of maximum drawdown, upstream barges

DOWNSTREAM BARGES



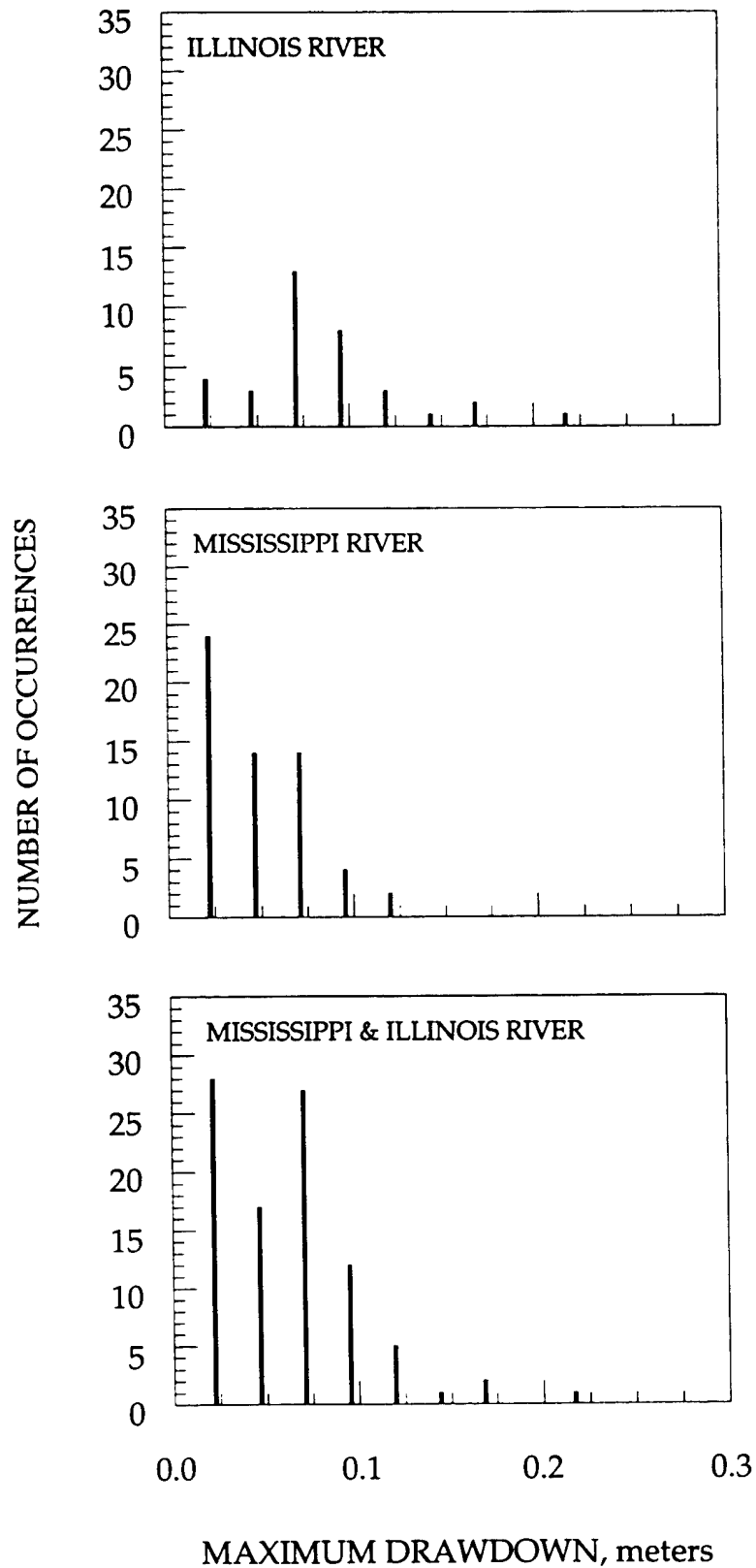
XXIV-2. Histograms of maximum drawdown, downstream barges

ALL BARGES



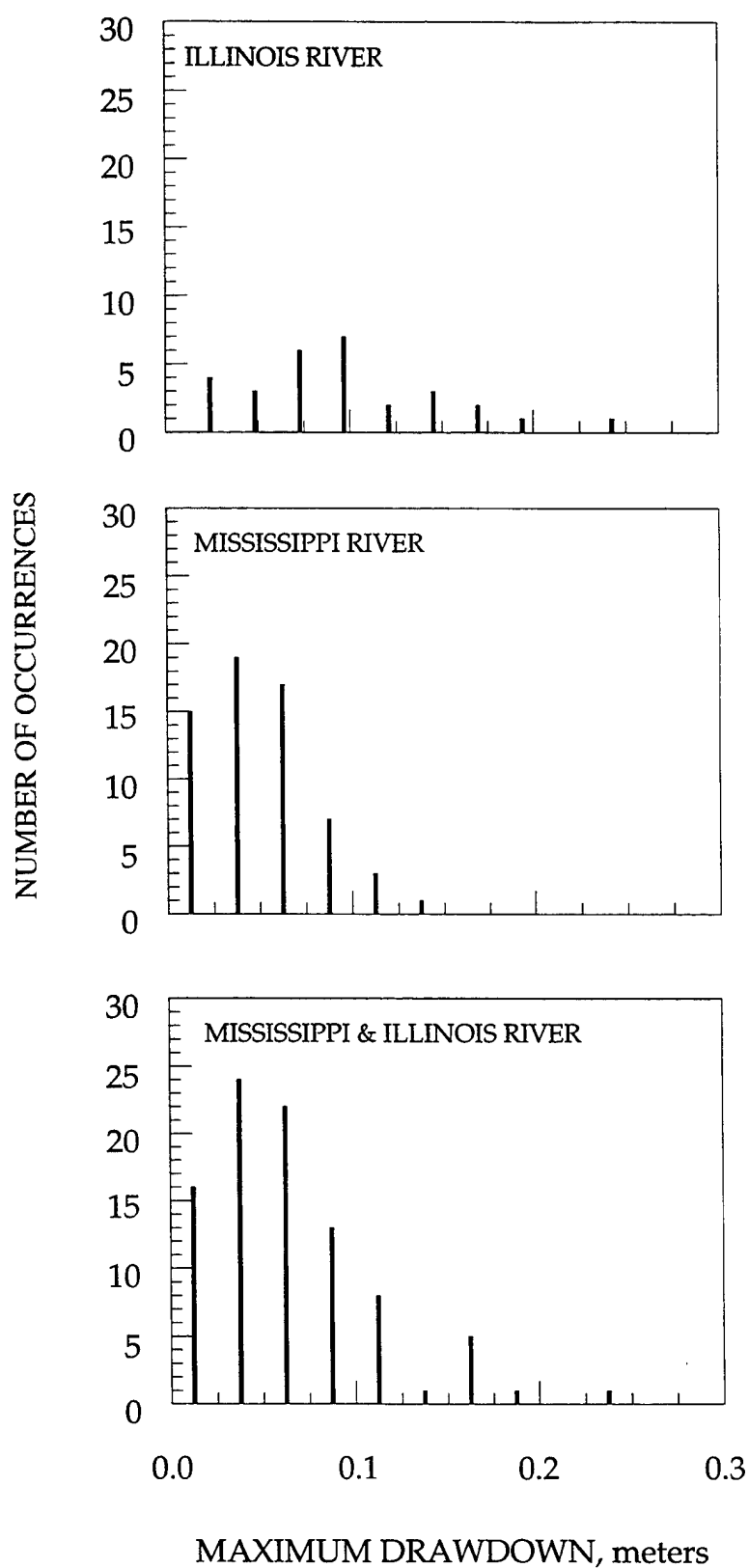
XXIV-3. Histograms of maximum drawdown, all barges

UPSTREAM BARGES



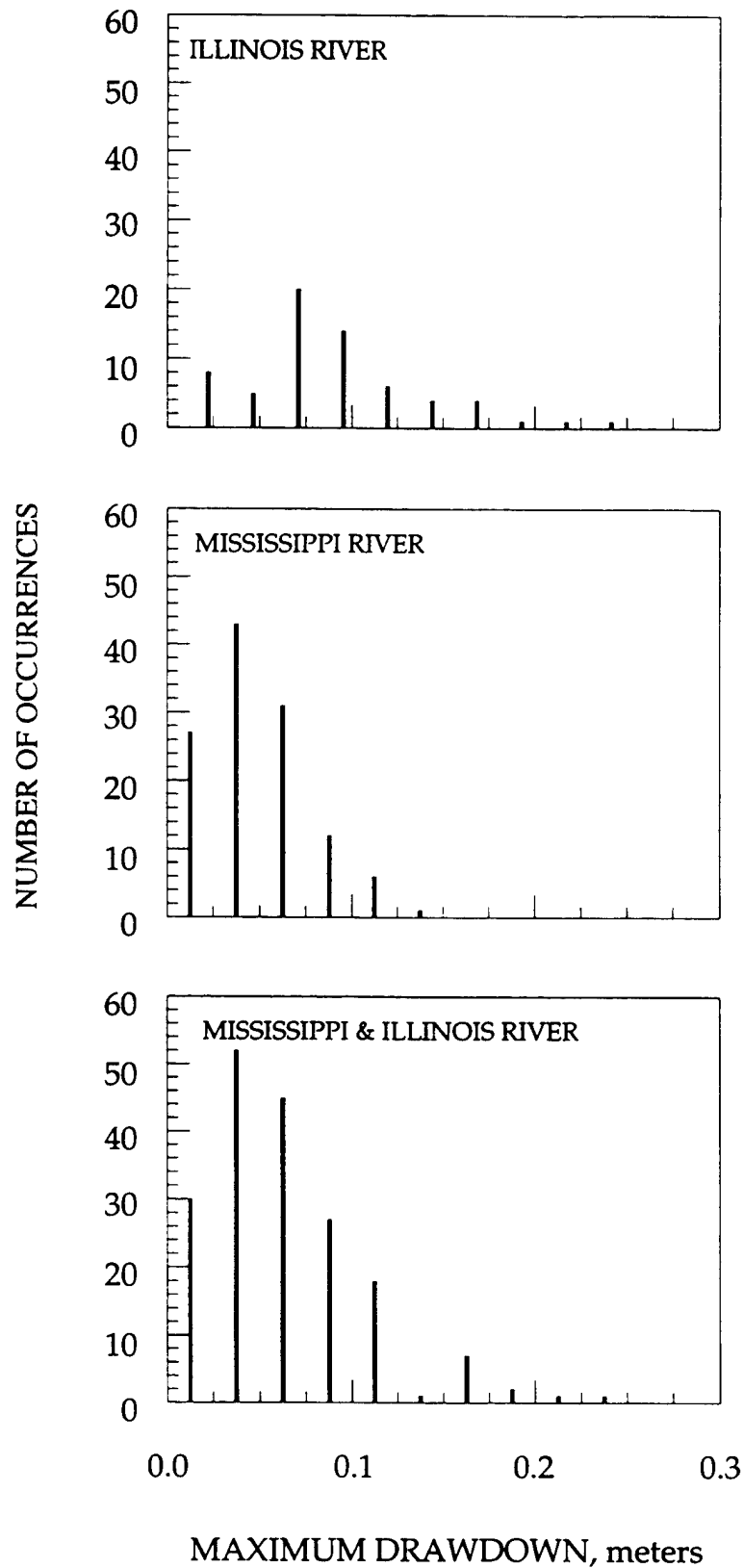
XXIV-4. Histograms of maximum drawdown for the river system, upstream barges

DOWNSTREAM BARGES



XXIV-5. Histograms of maximum drawdown for the river system, downstream barges

ALL BARGES



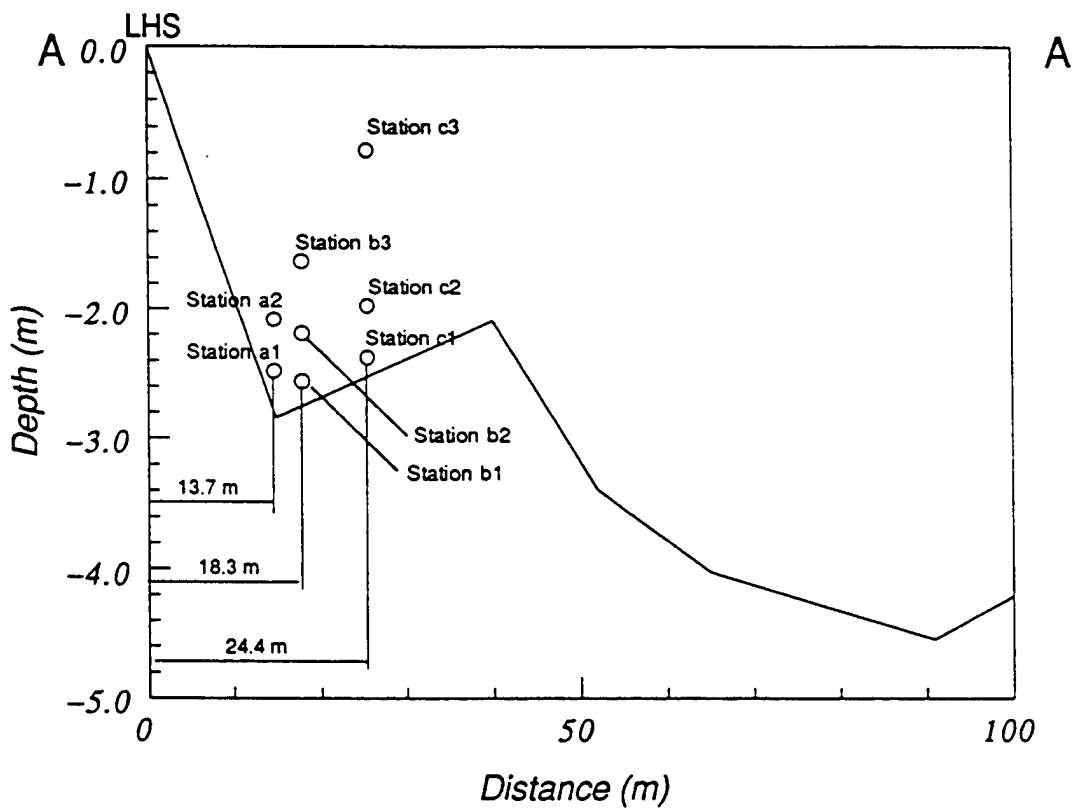
XXIV-6. Histograms of maximum drawdown for the river system, all barges

APPENDIX XXV.

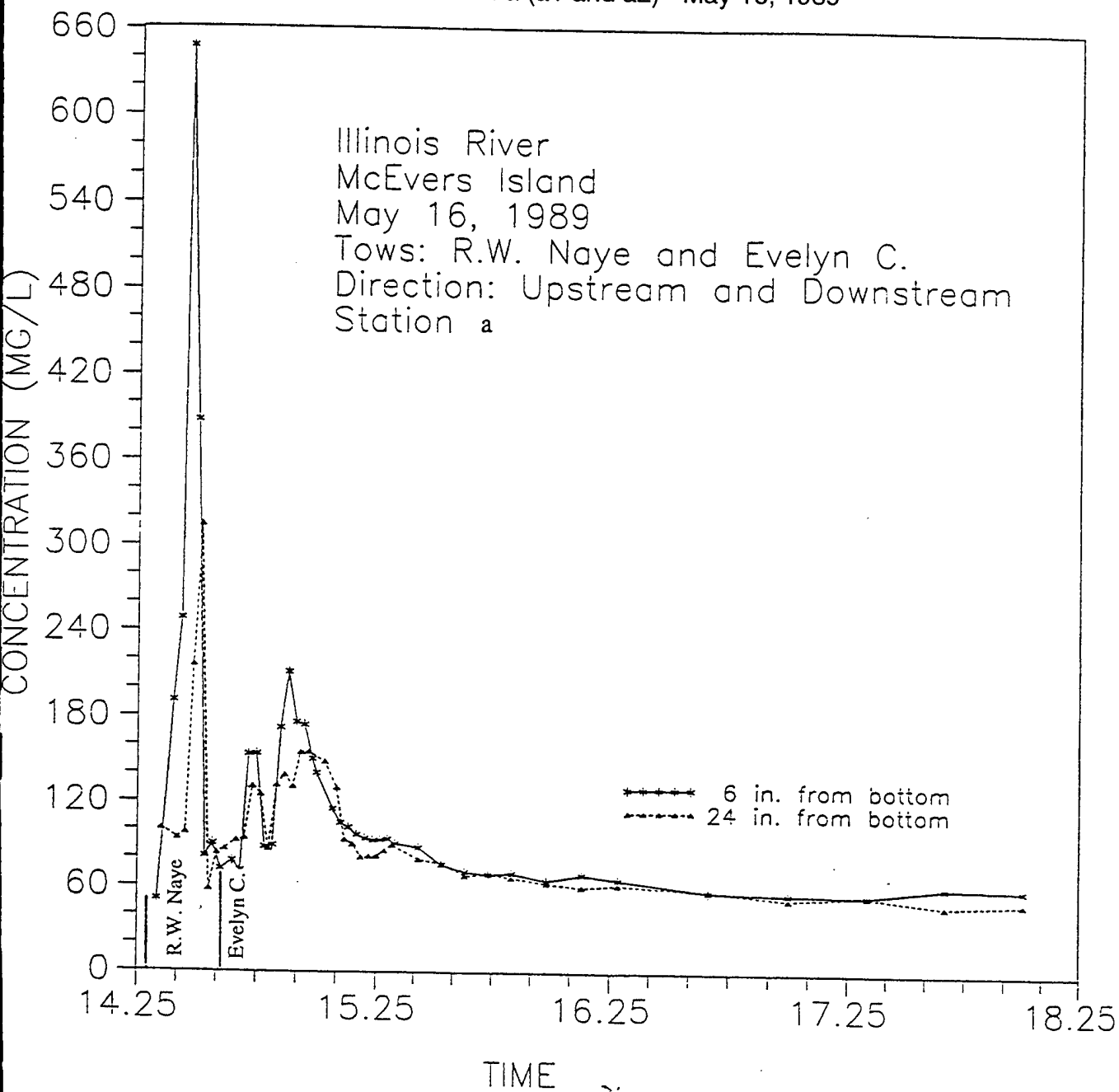
TYPICAL PLOTS OF SUSPENDED SEDIMENT CONCENTRATION VERSUS TIME

XXV-1. Variation of suspended sediment concentration with time, McEver's Island

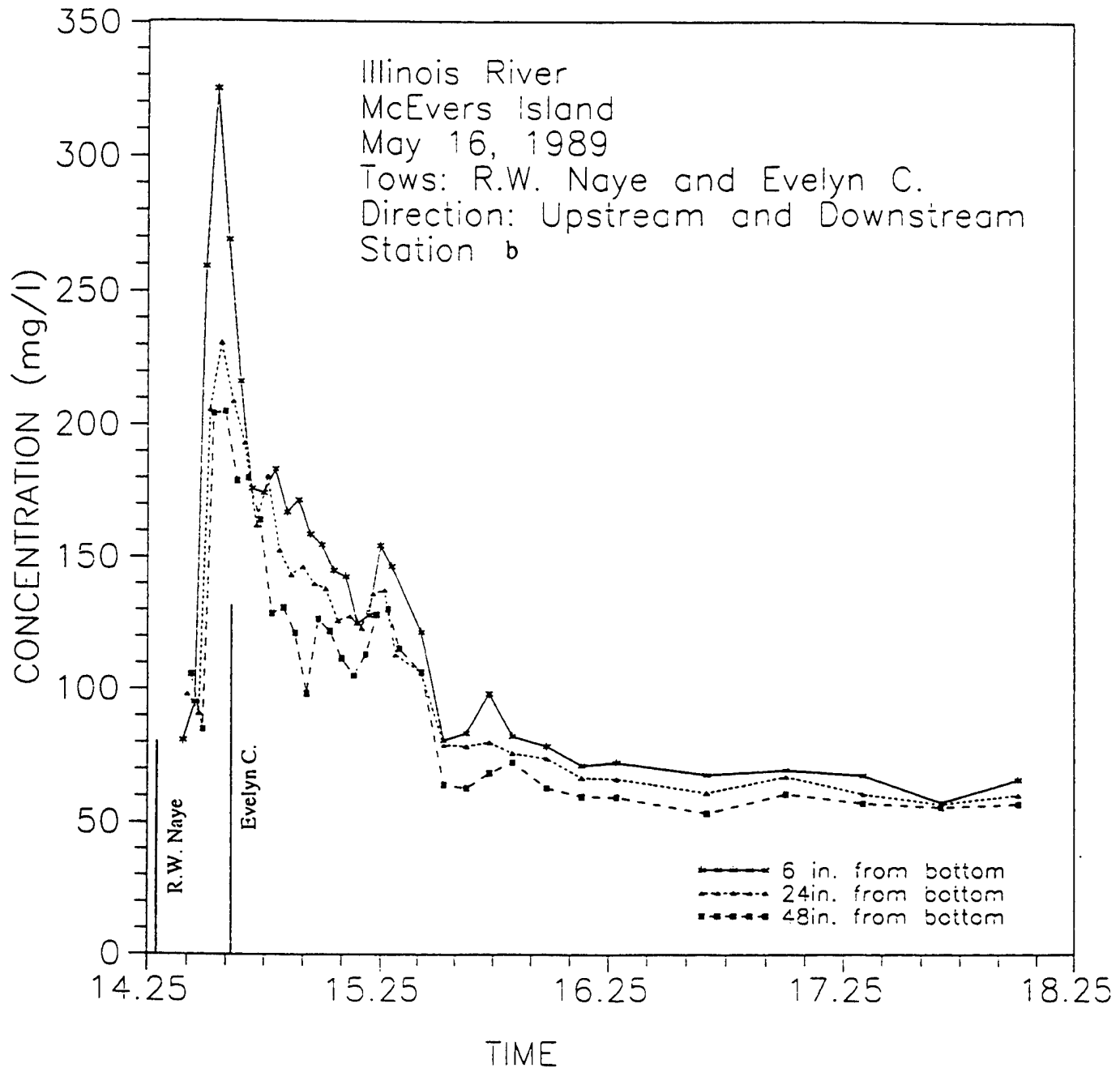
Location of suspended sediment sampling stations on the Illinois River
near the McEver's Island site during May 15-19, 1989



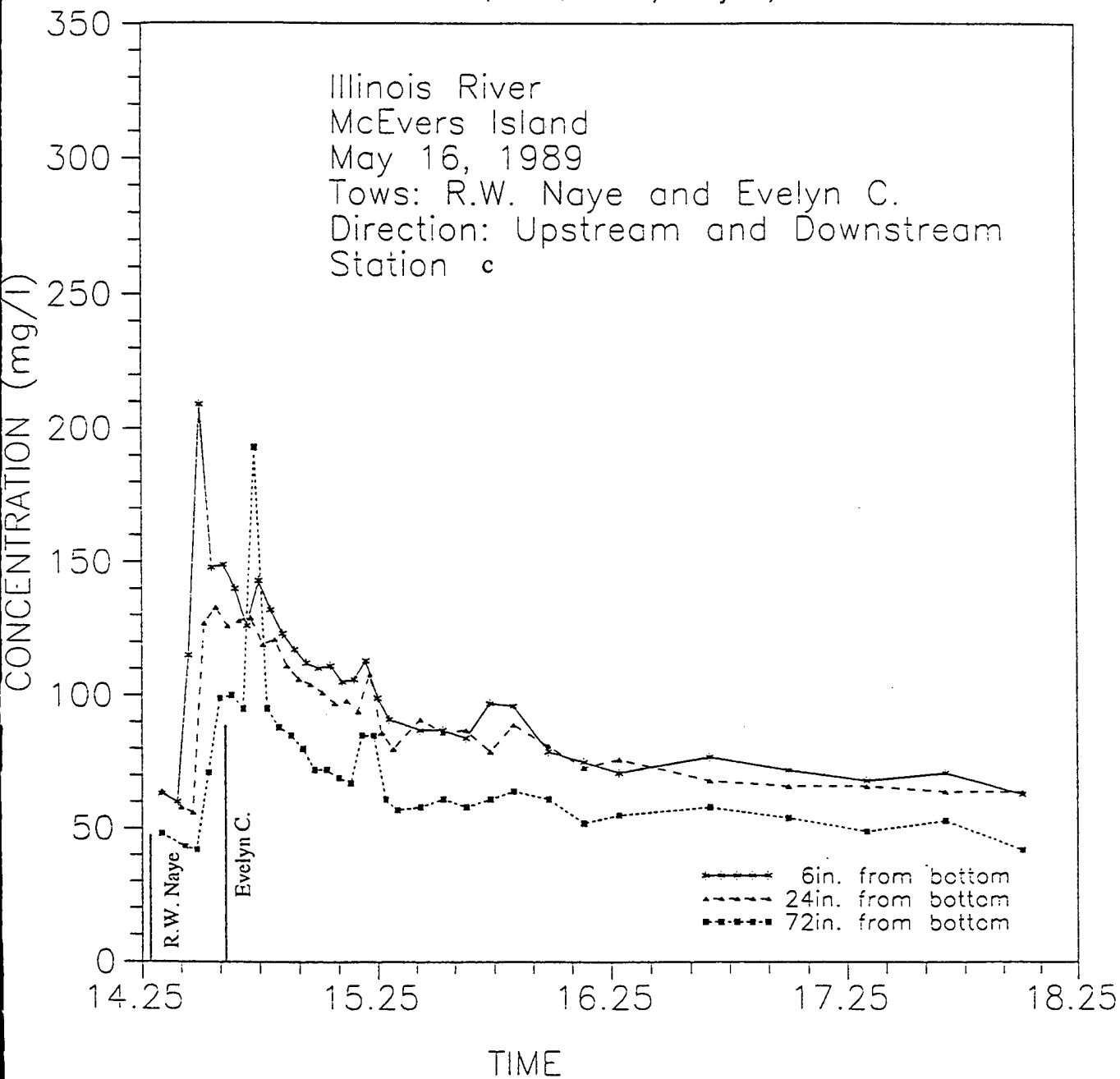
Station a (a1 and a2) May 16, 1989



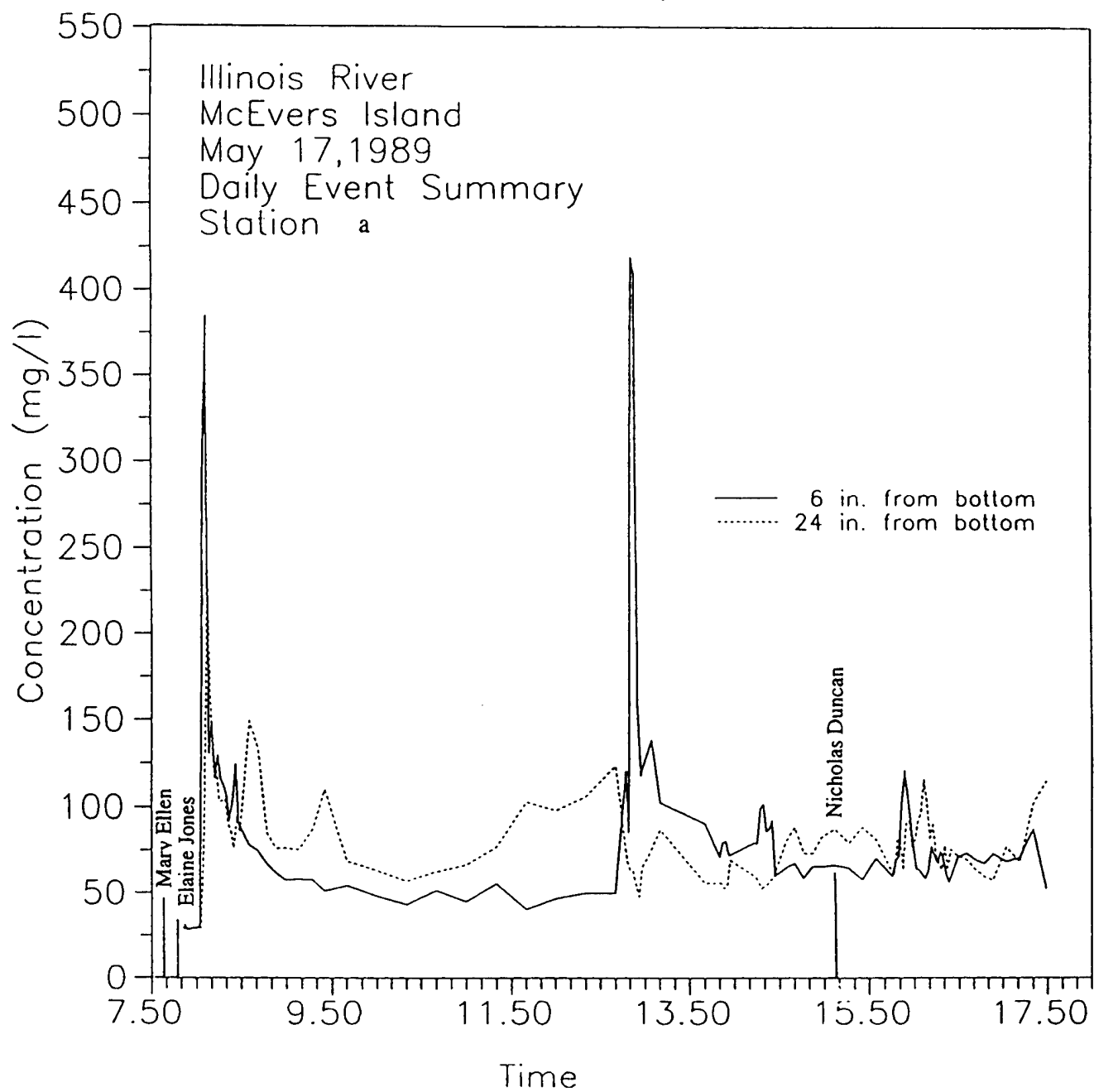
Station b (b1, b2, and b3) May 16, 1989



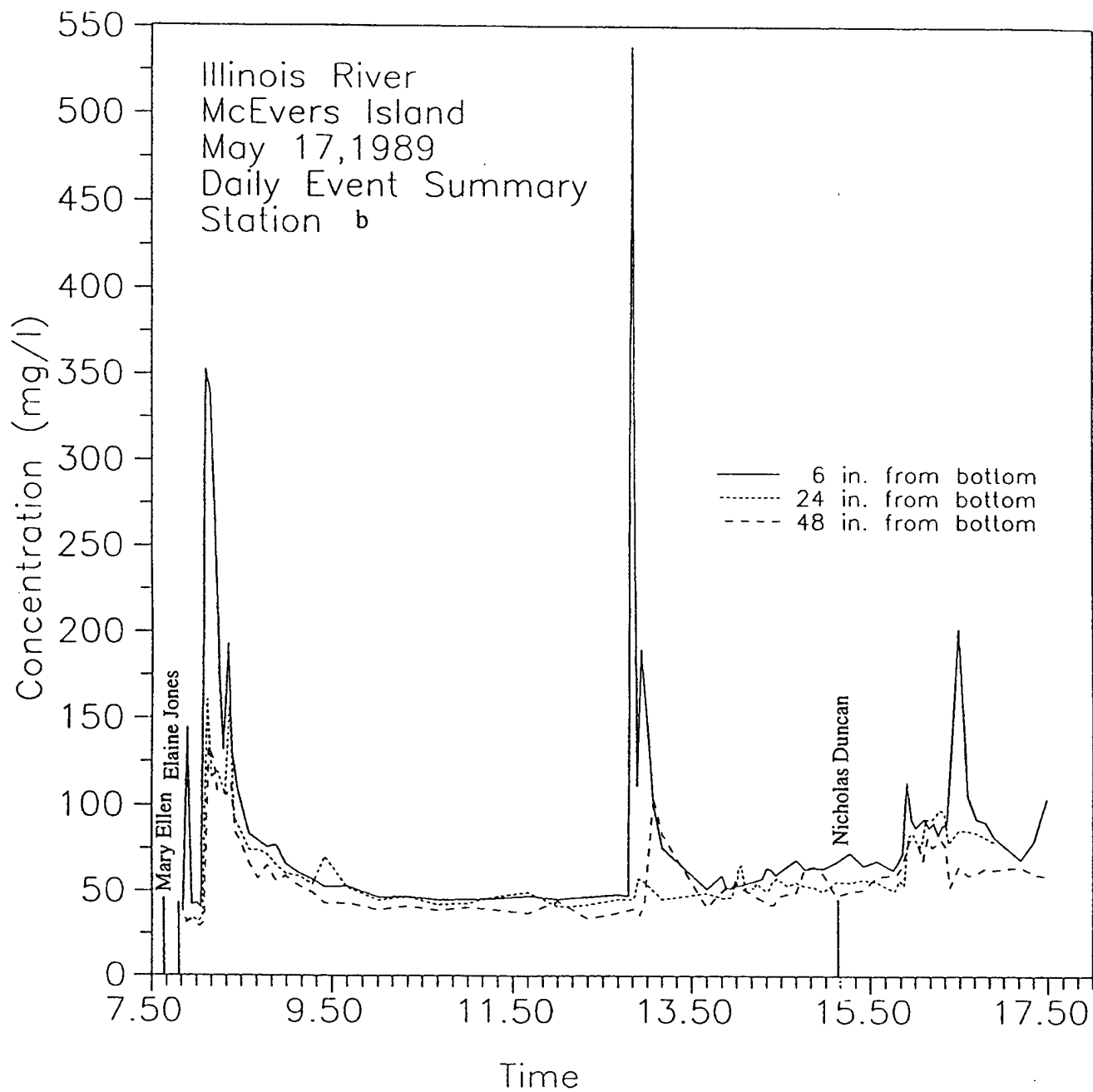
Station c (c1, c2, and c3) May 16, 1989



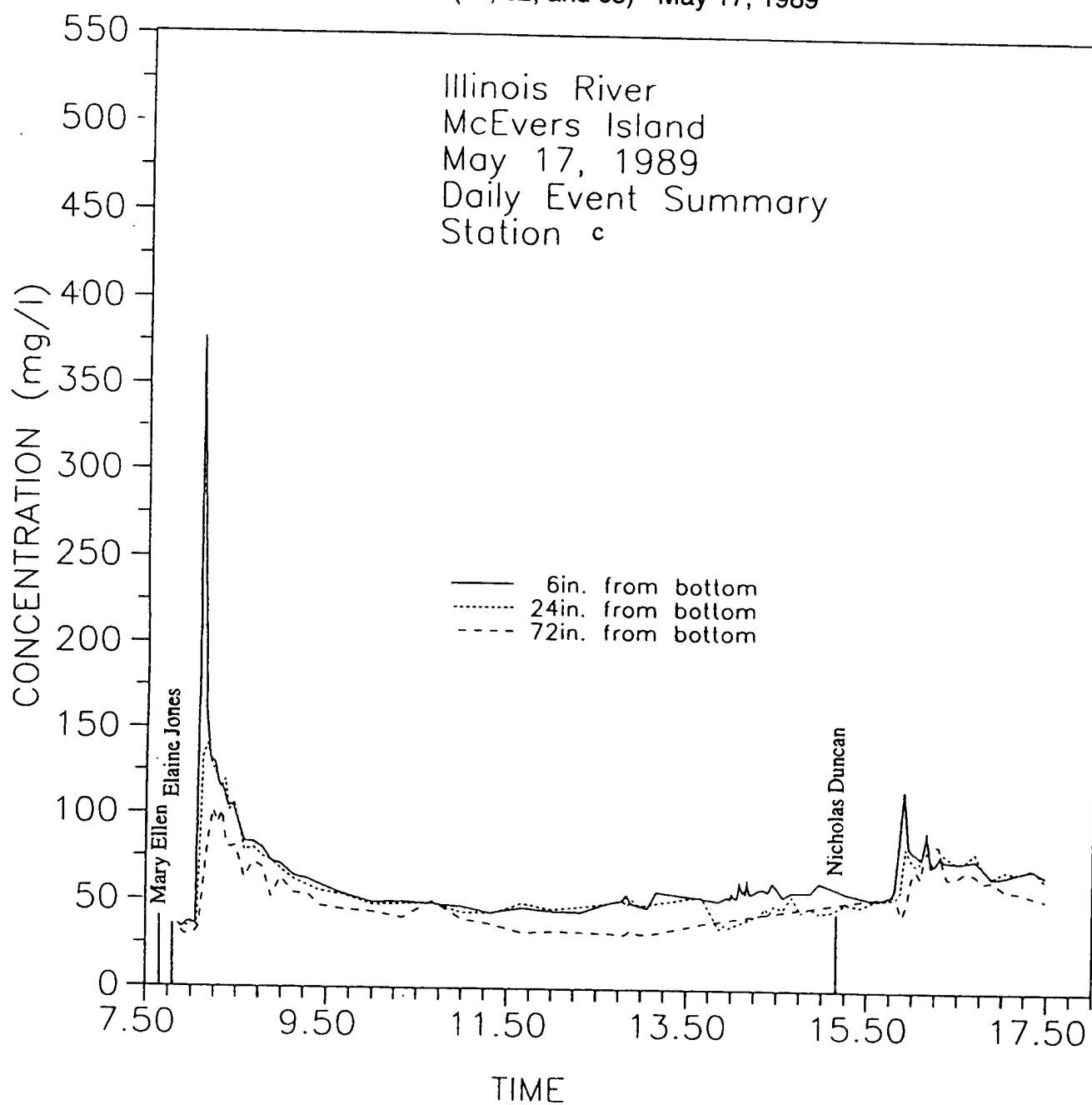
Station a (a1 and a2) May 17, 1989



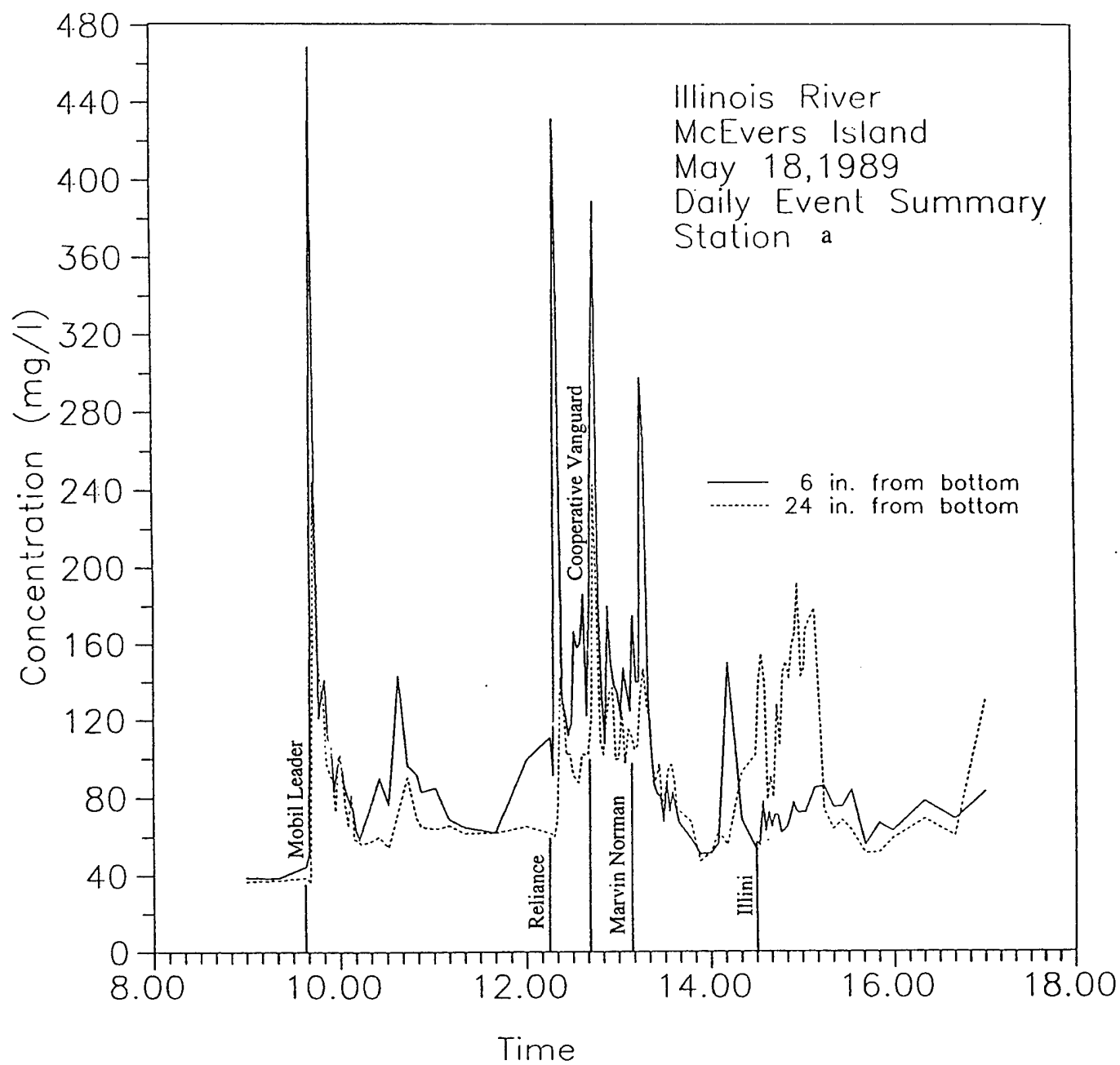
Station b (b1, b2, and b3) May 17, 1989



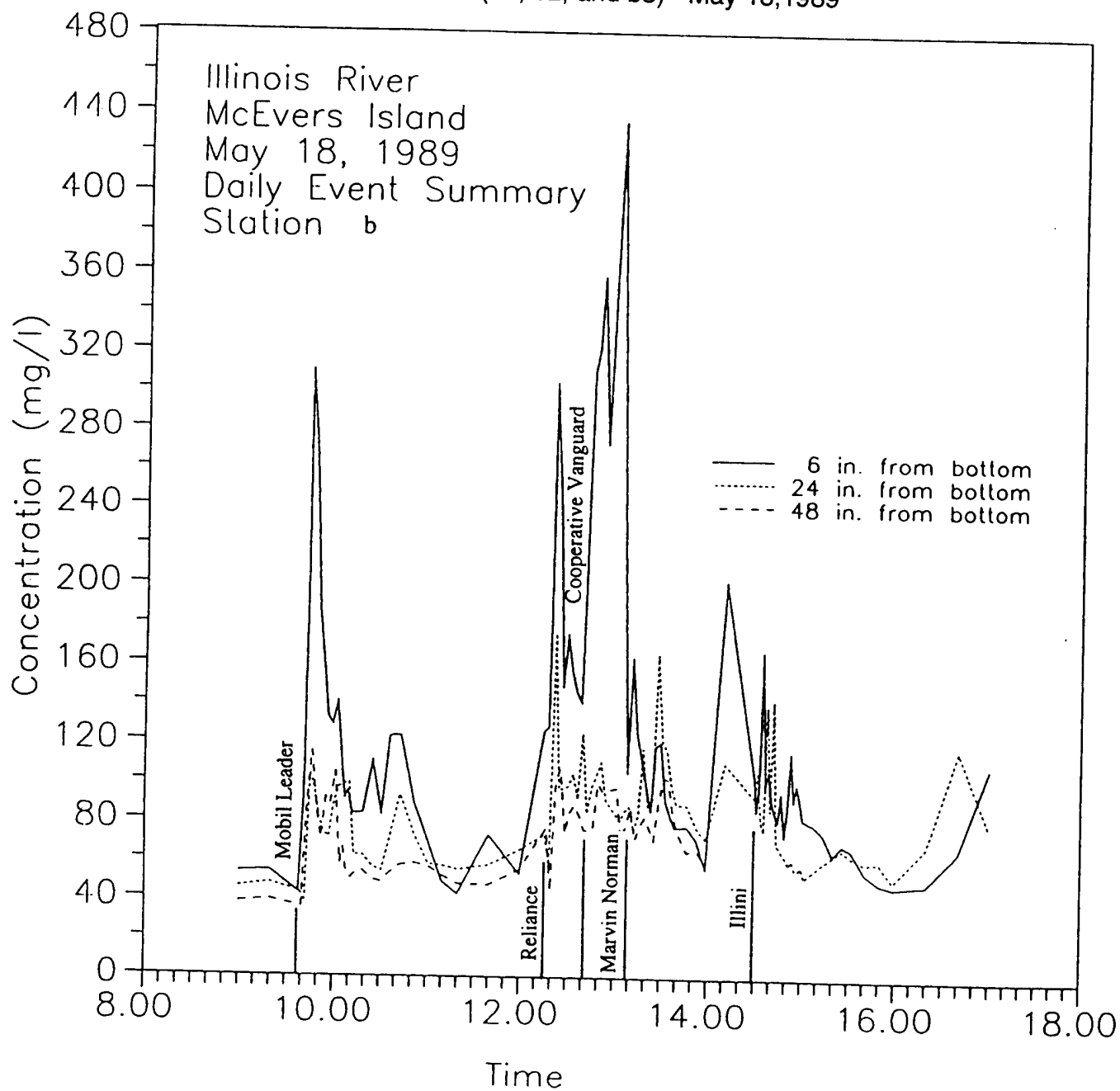
Station c (c1, c2, and c3) May 17, 1989



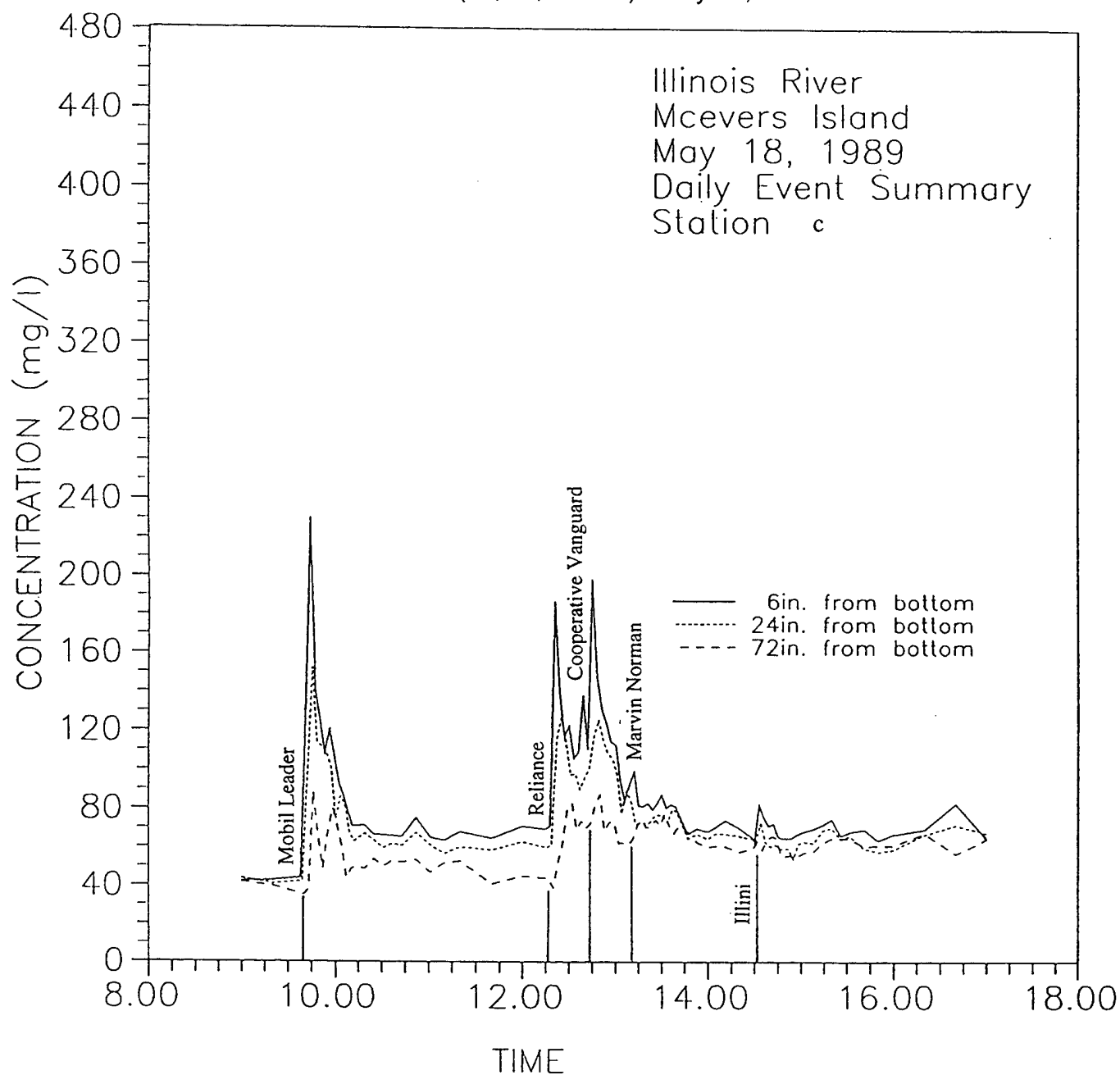
Station a (a1 and a2) May 18, 1989



Station b (b1, b2, and b3) May 18, 1989

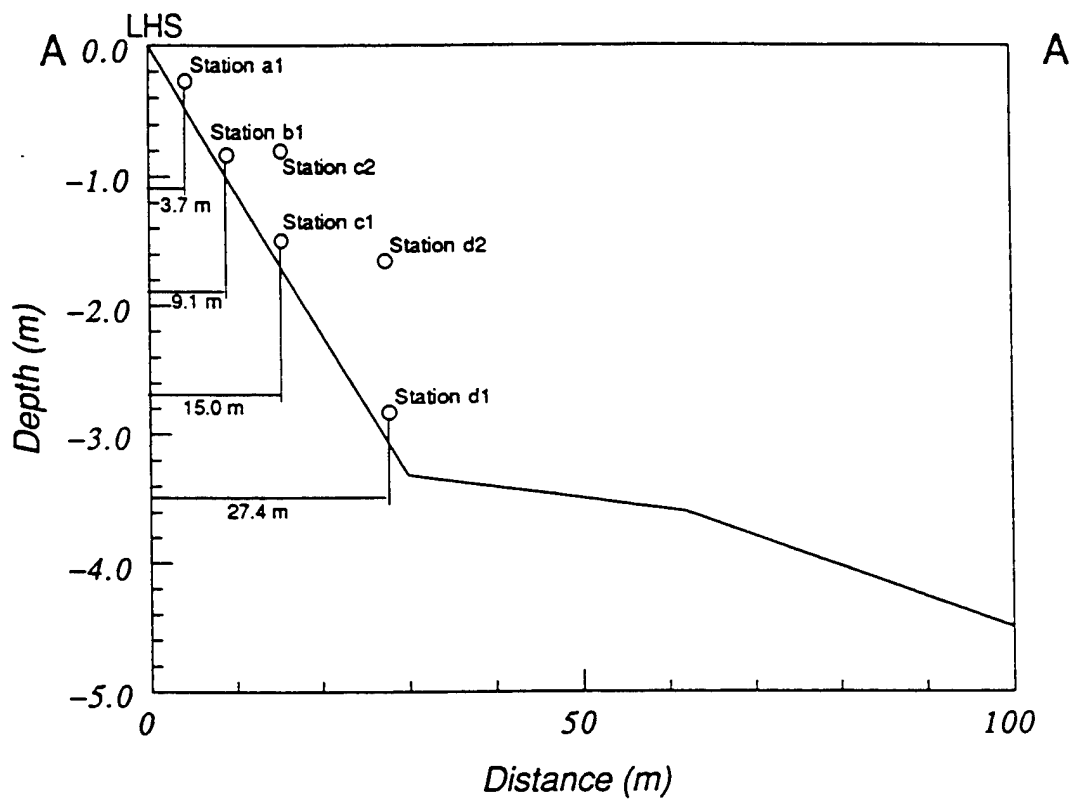


Station c (c1, c2, and c3) May 18, 1989

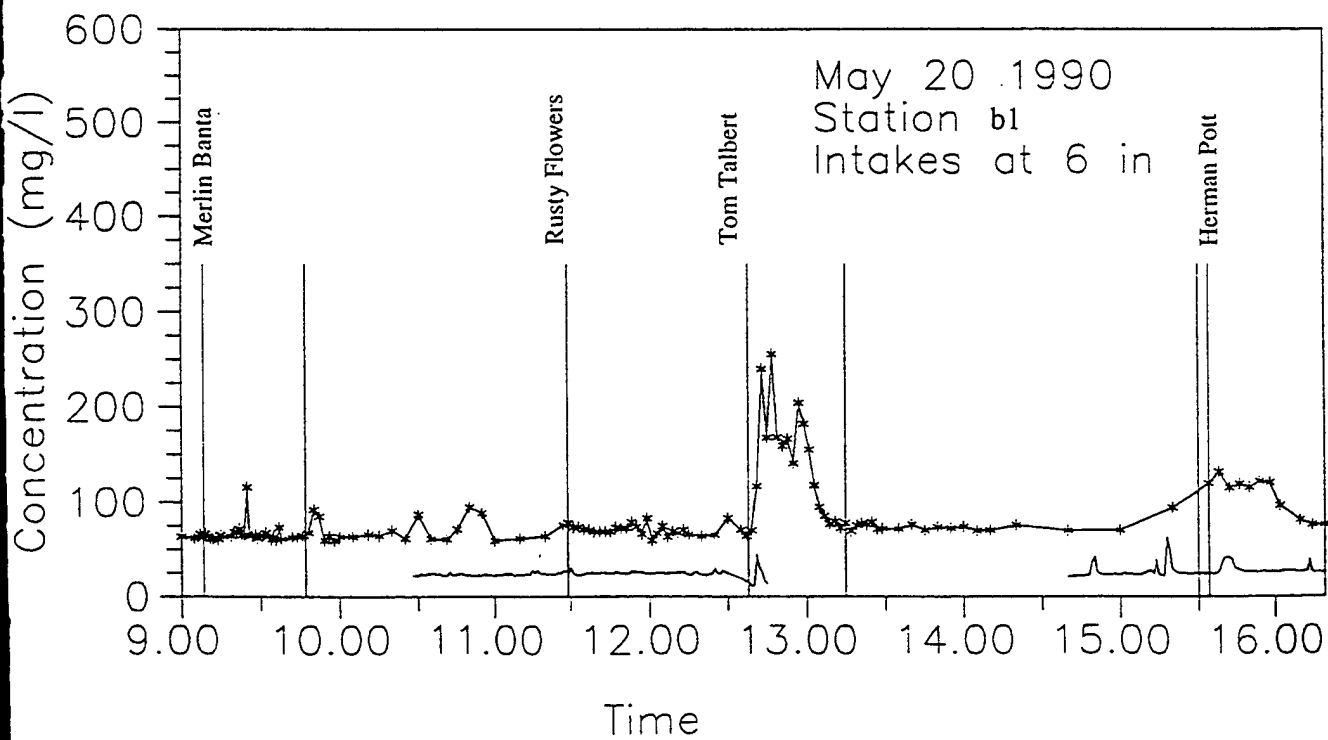
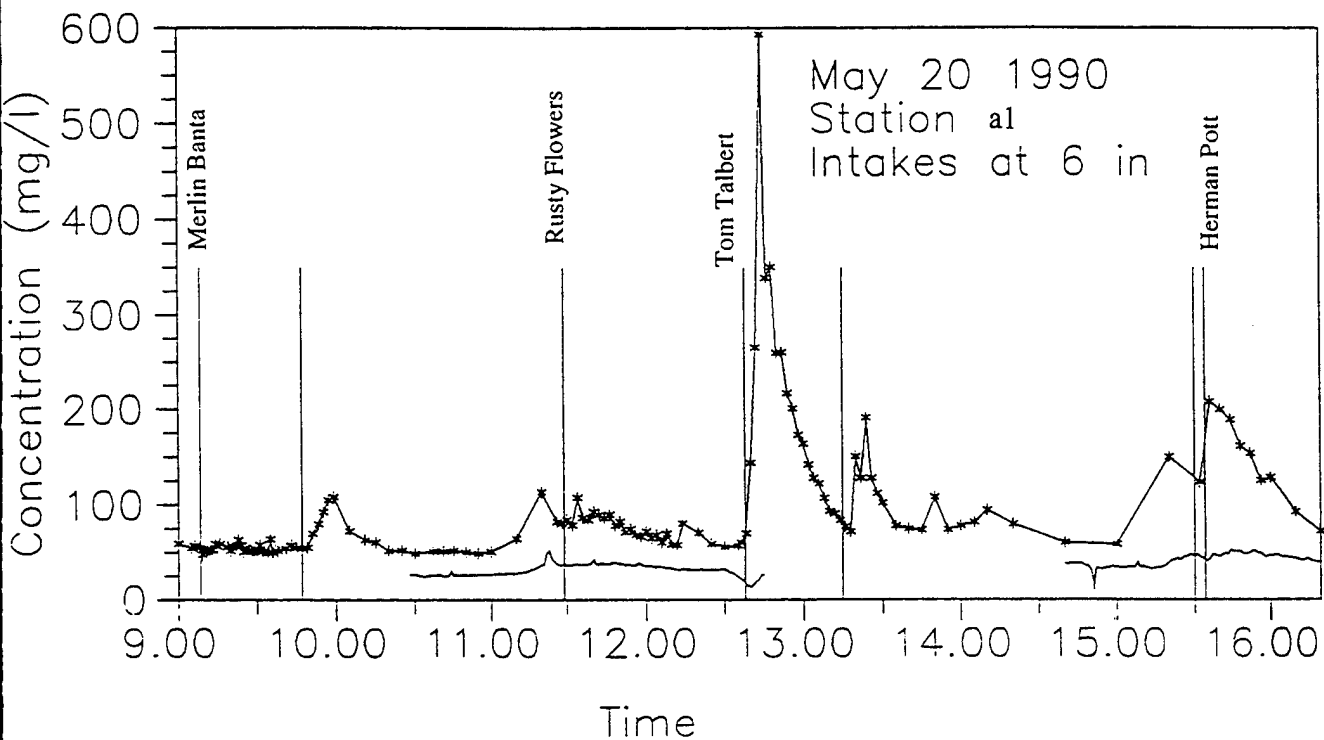


XXV-2. Variation of suspended sediment concentration with time, Apple River Island

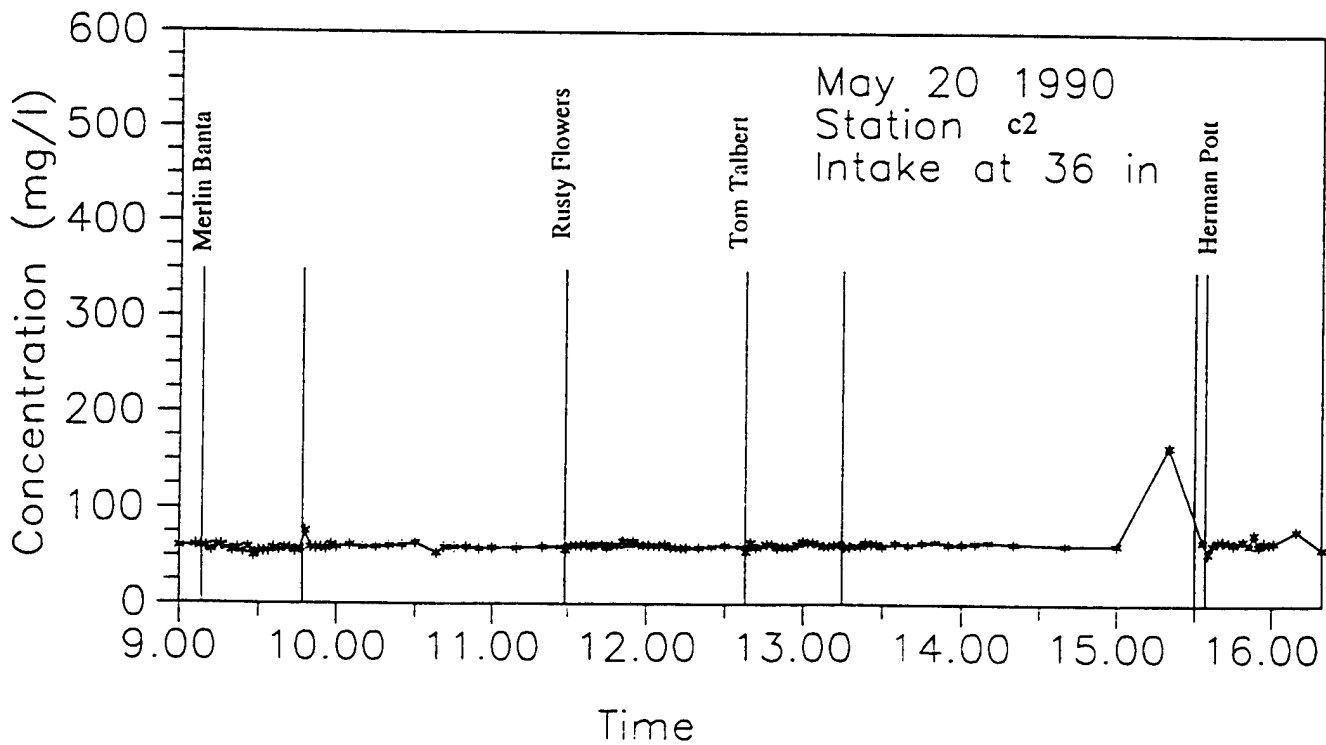
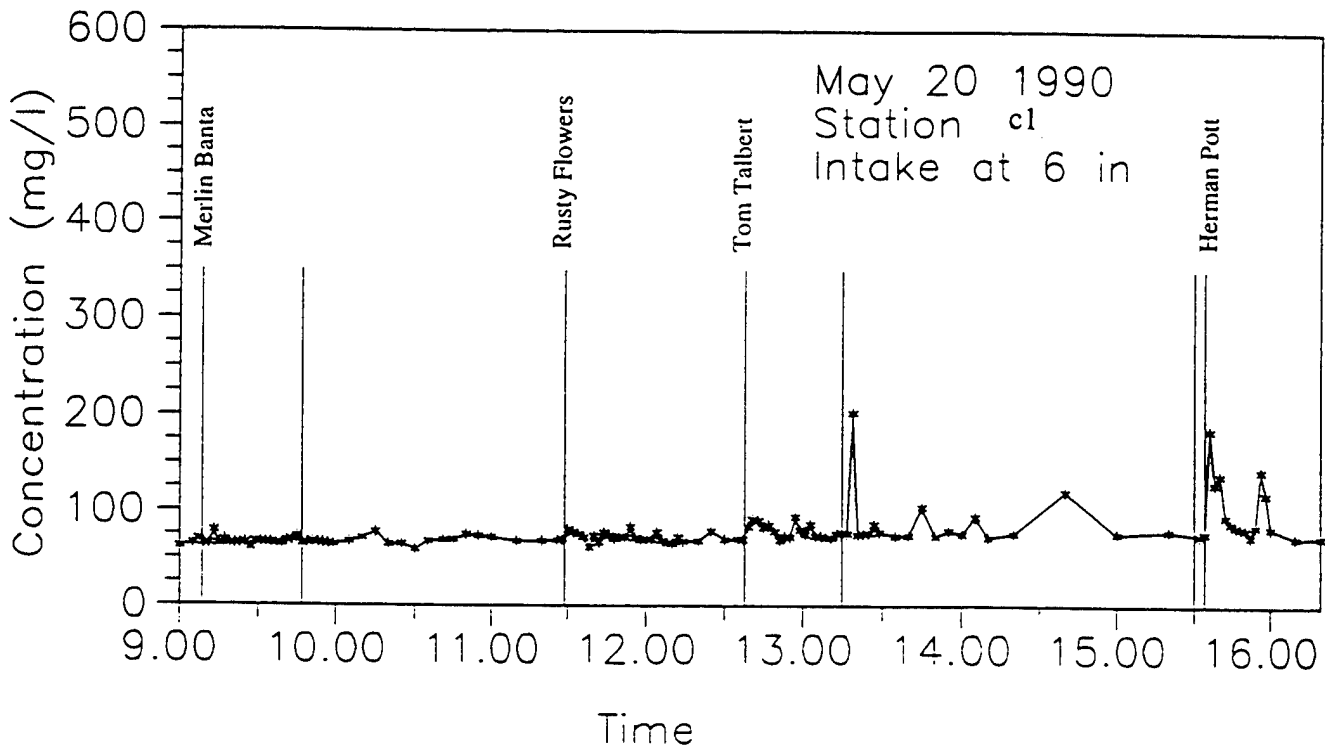
Location of suspended sediment sampling stations on the Mississippi River
near the Apple River Island site during May 14-25, 1990



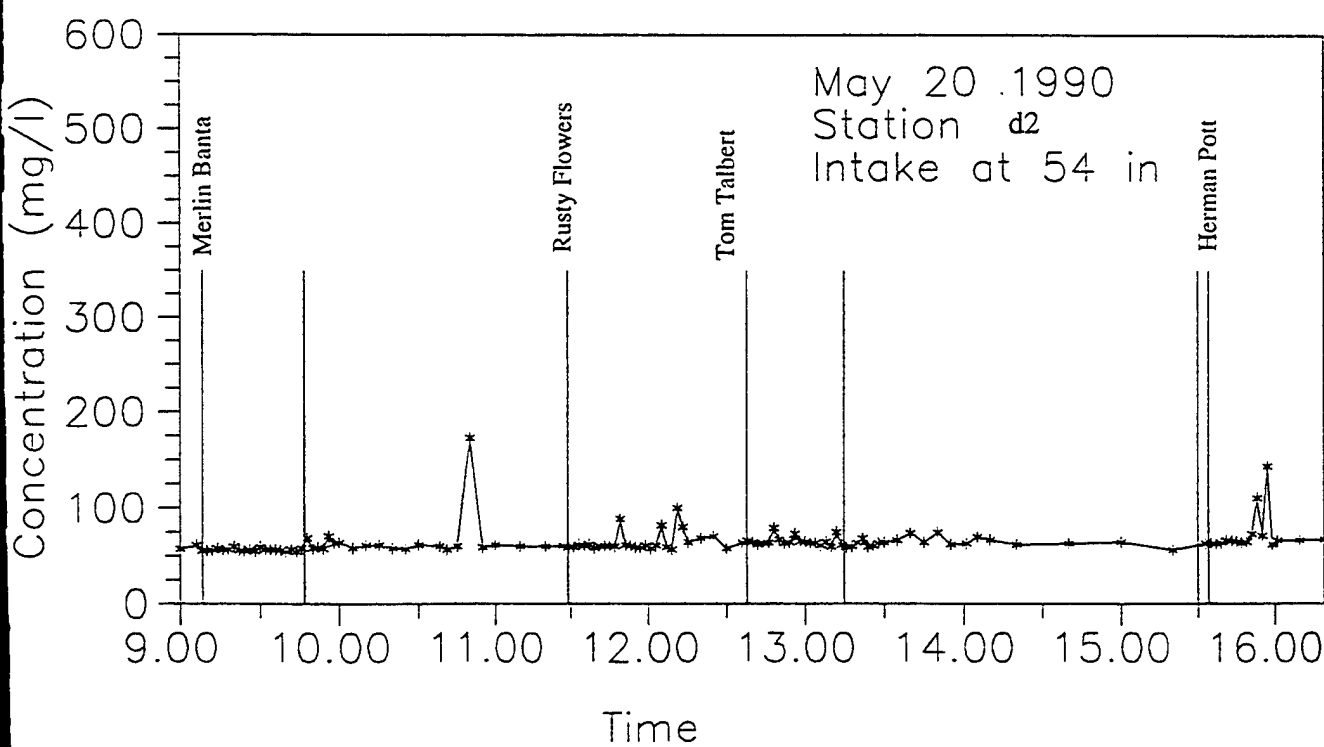
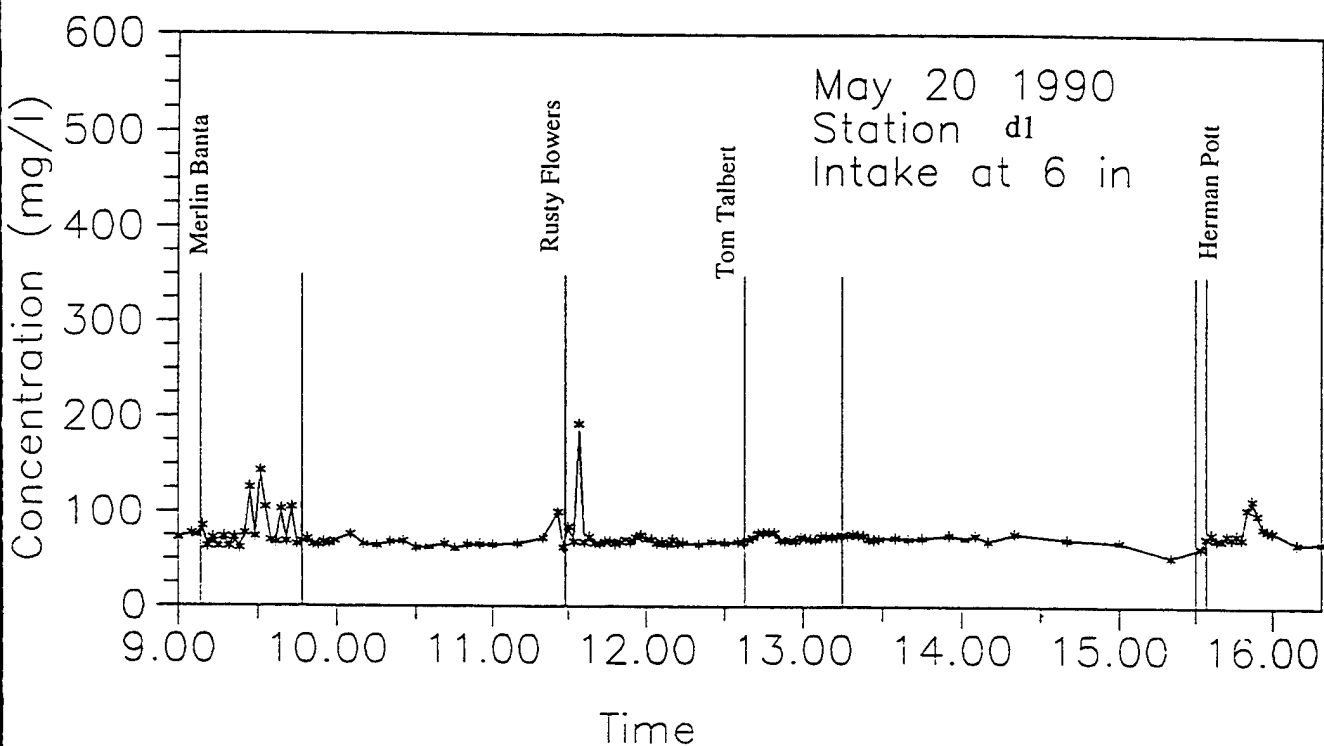
Stations a1 and b1 May 20, 1990



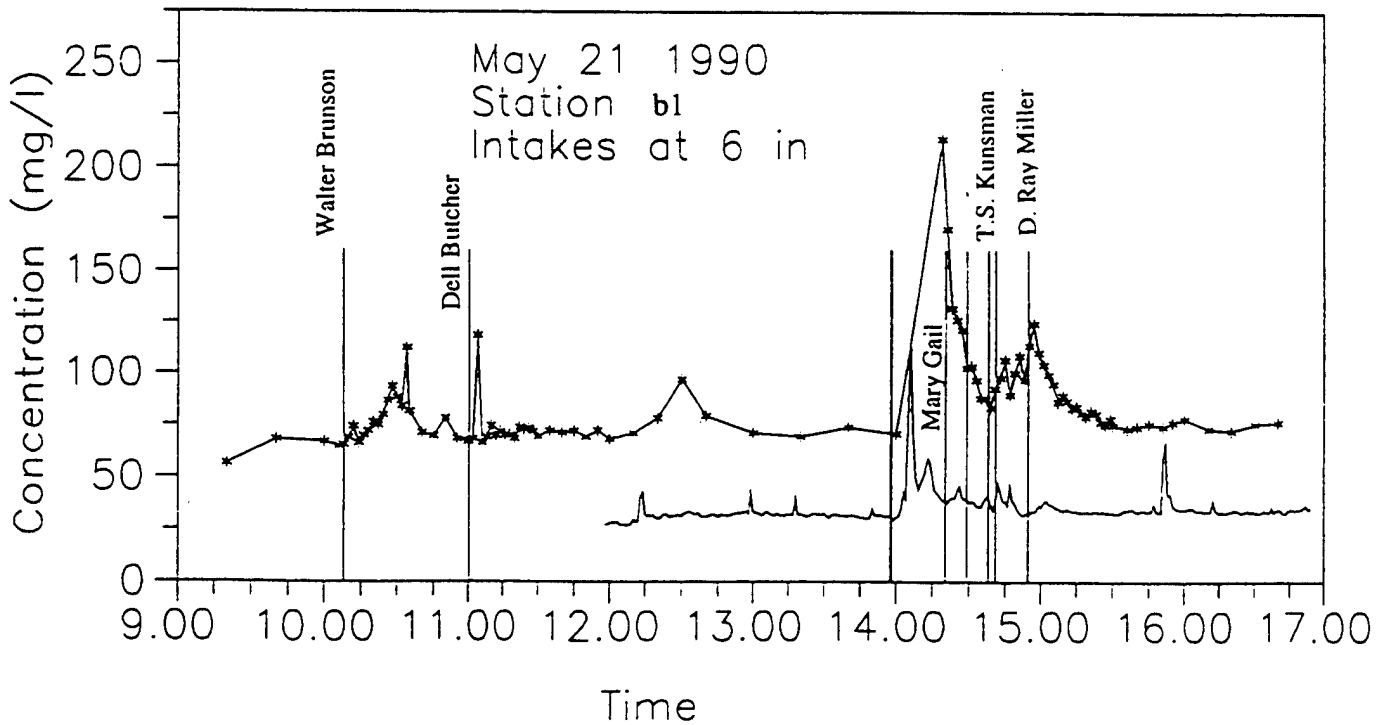
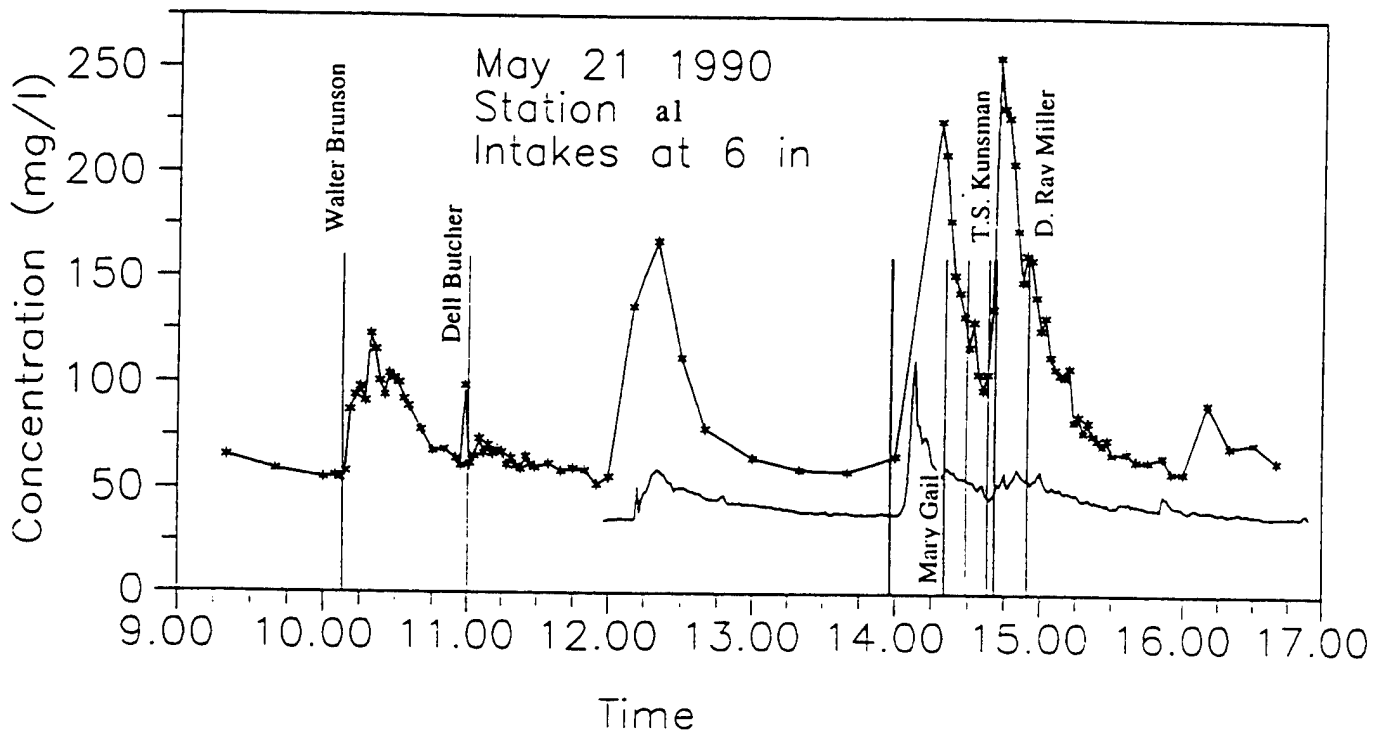
Stations c1 and c2 May 20, 1990



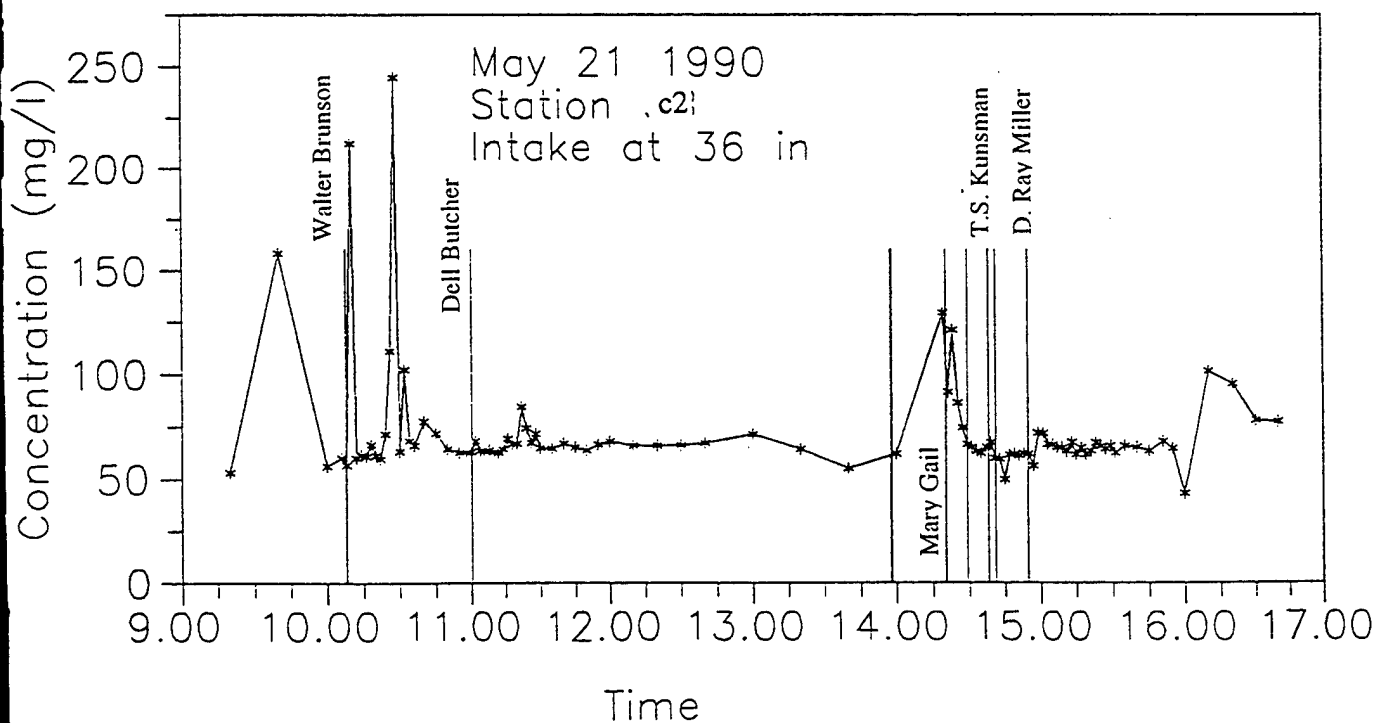
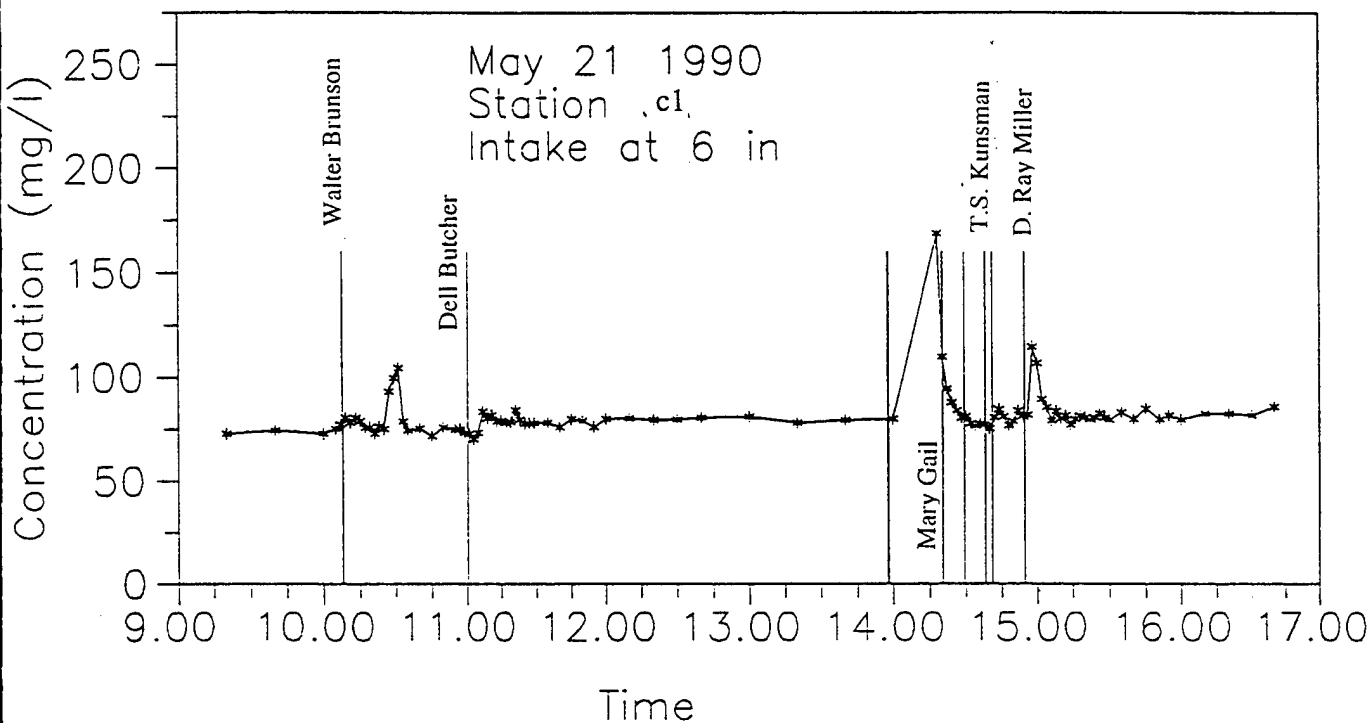
Stations d1 and d2 May 20, 1990



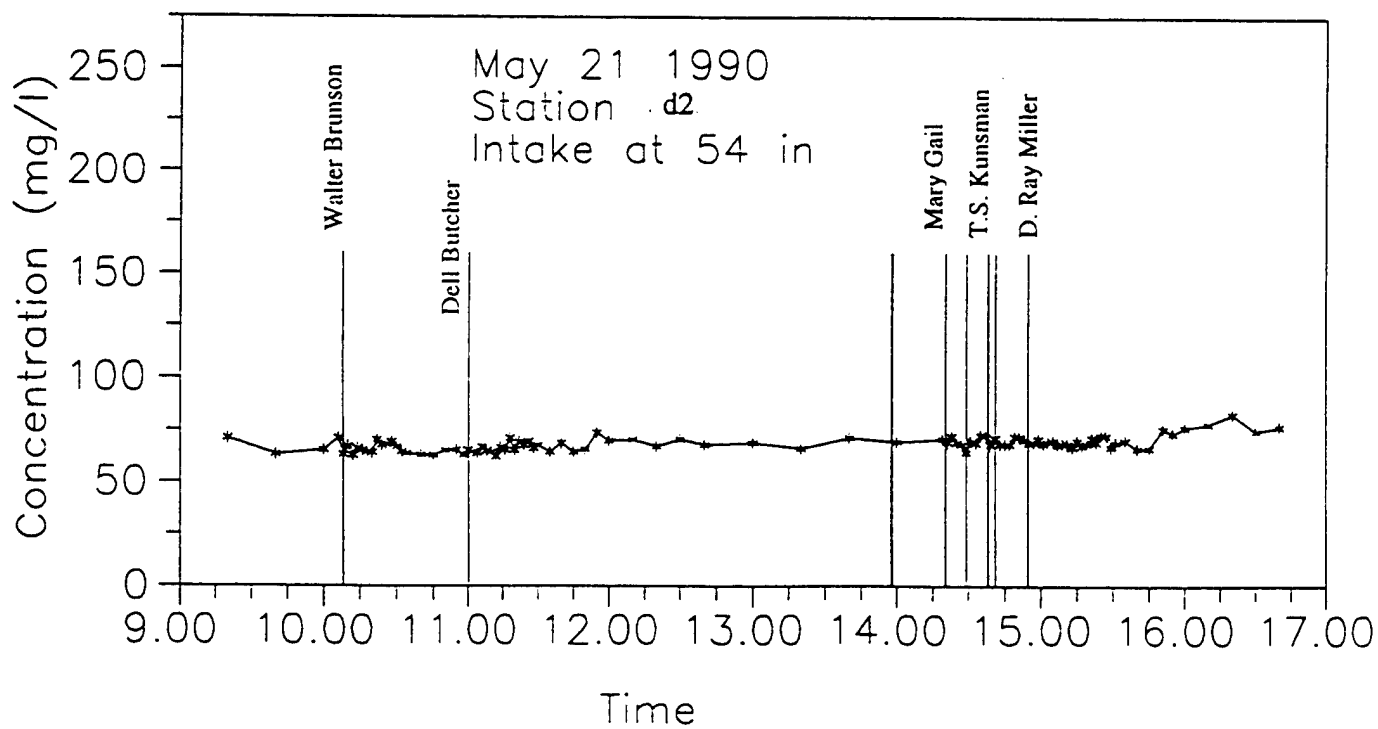
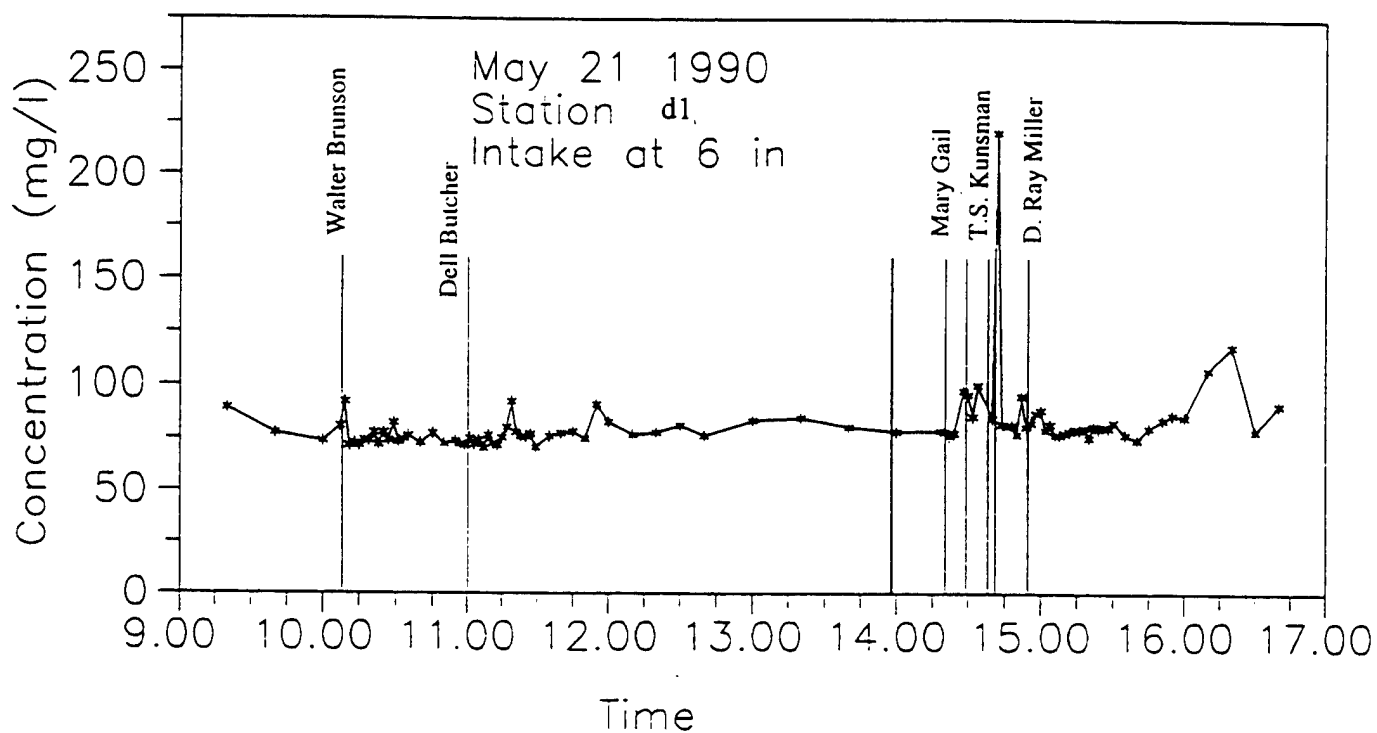
Stations a1 and b1 May 21, 1990



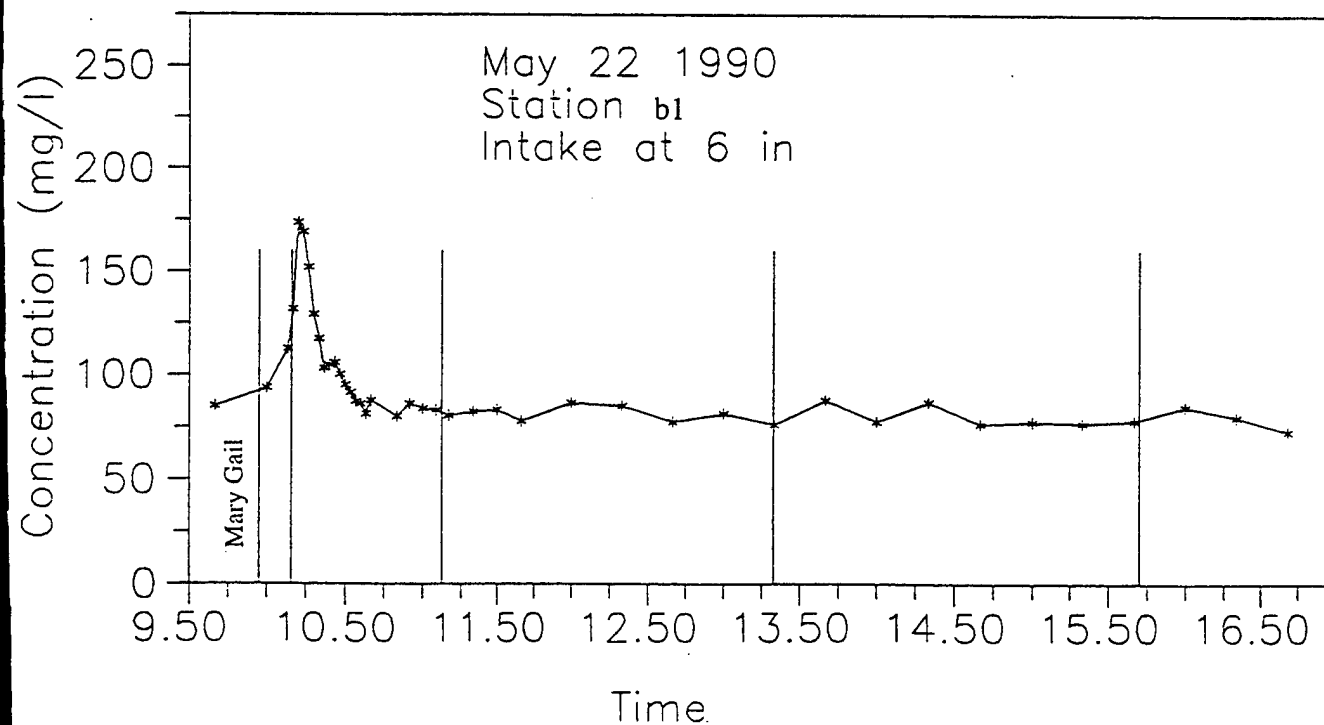
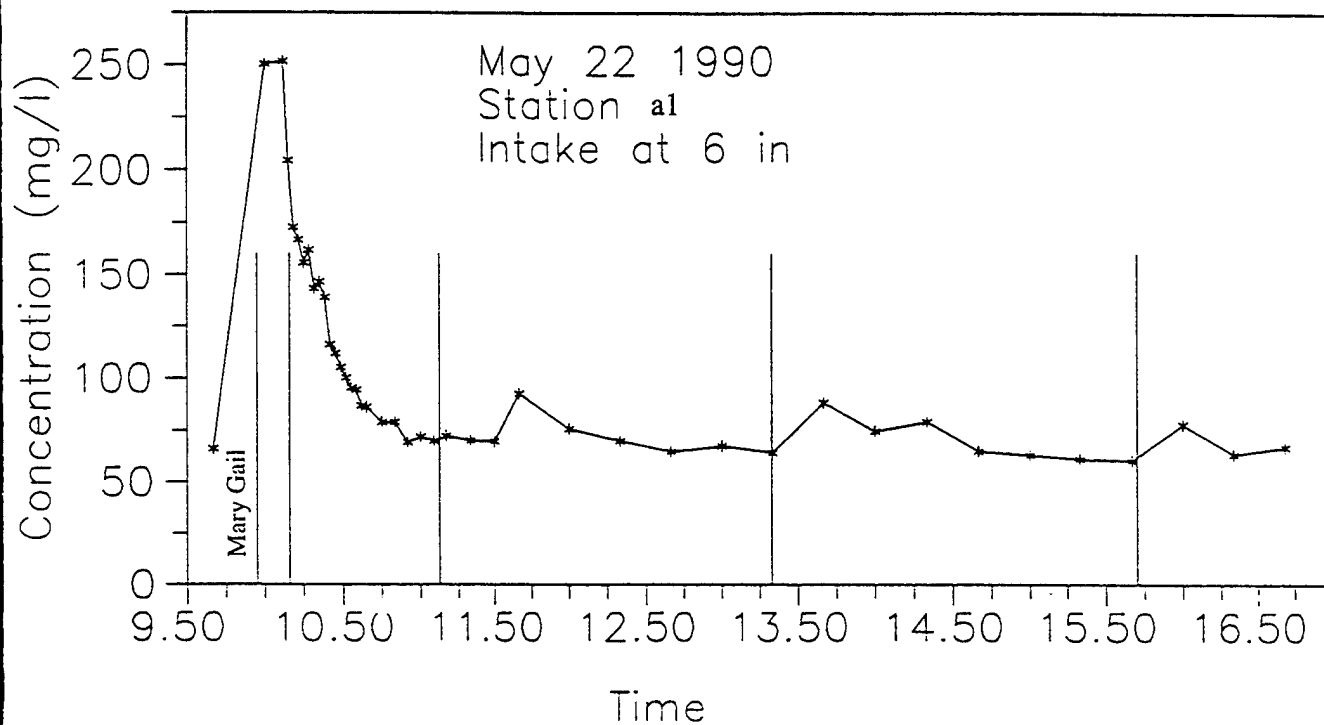
Stations c1 and c2 May 21, 1990



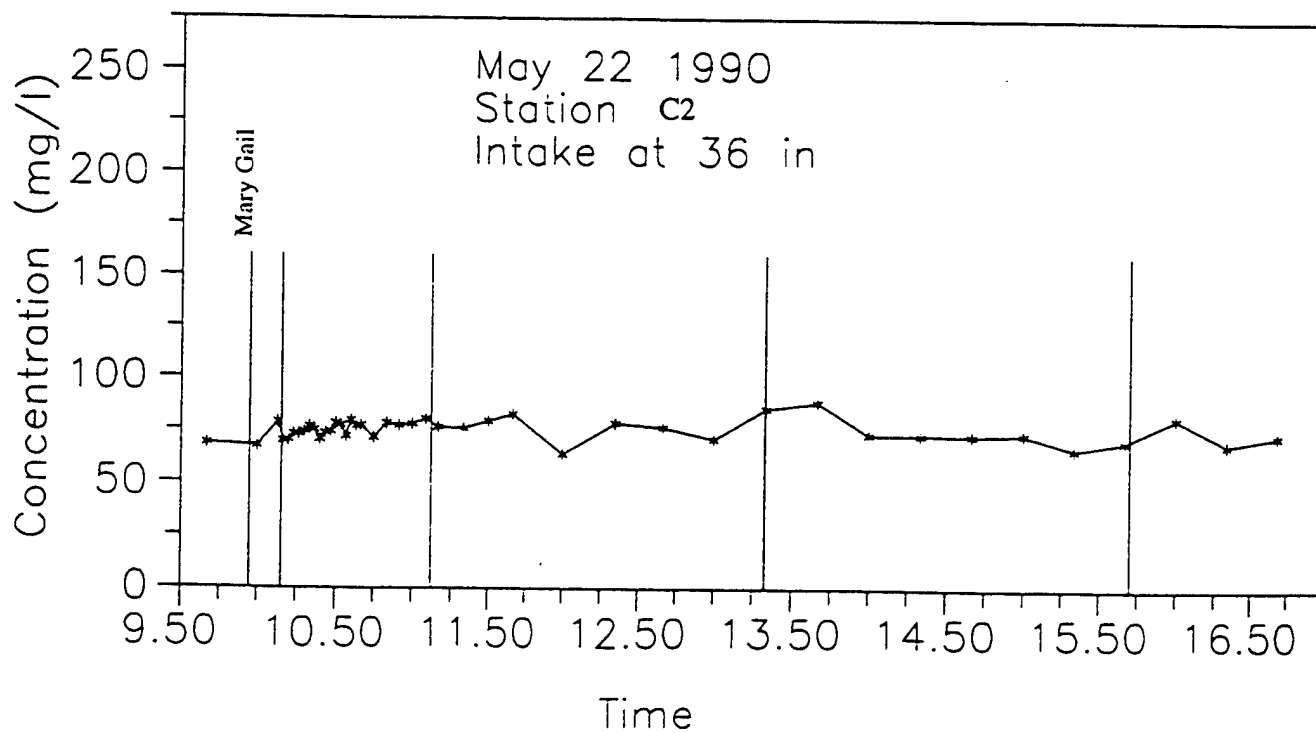
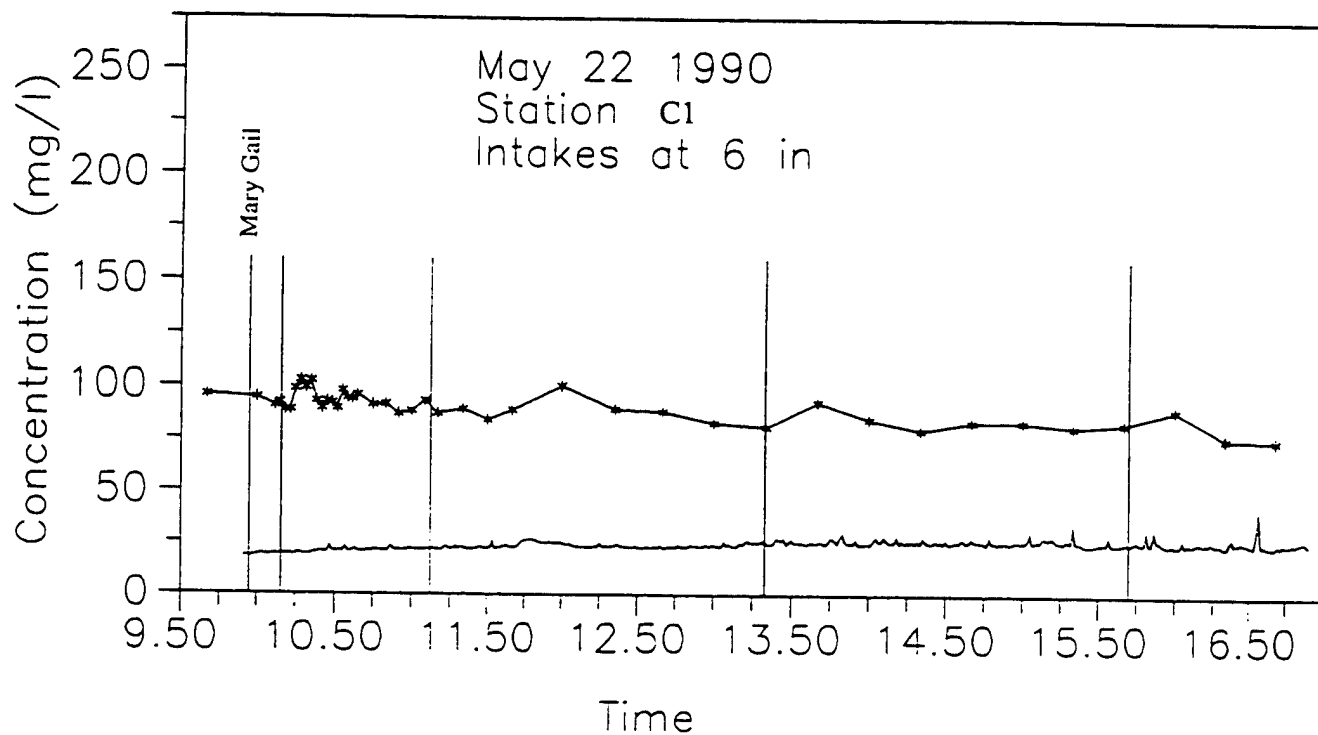
Stations d1 and d2 May 21, 1990



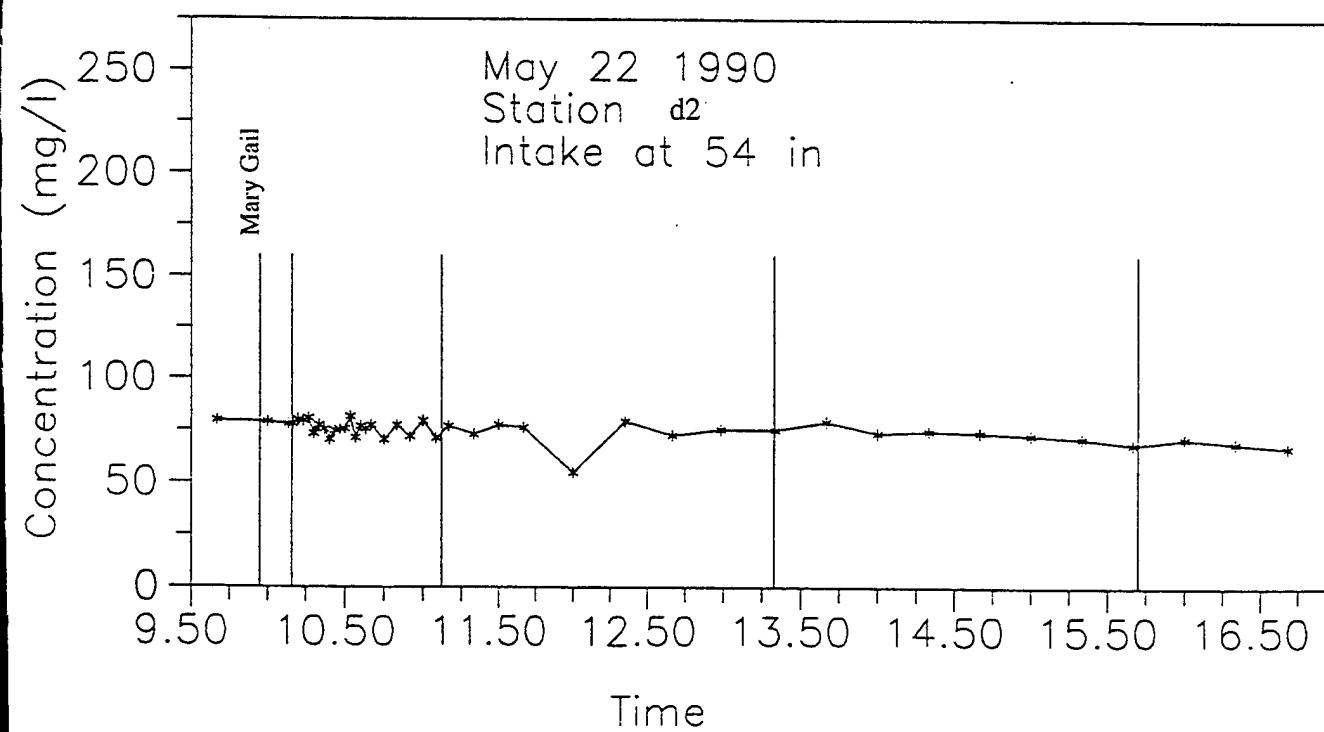
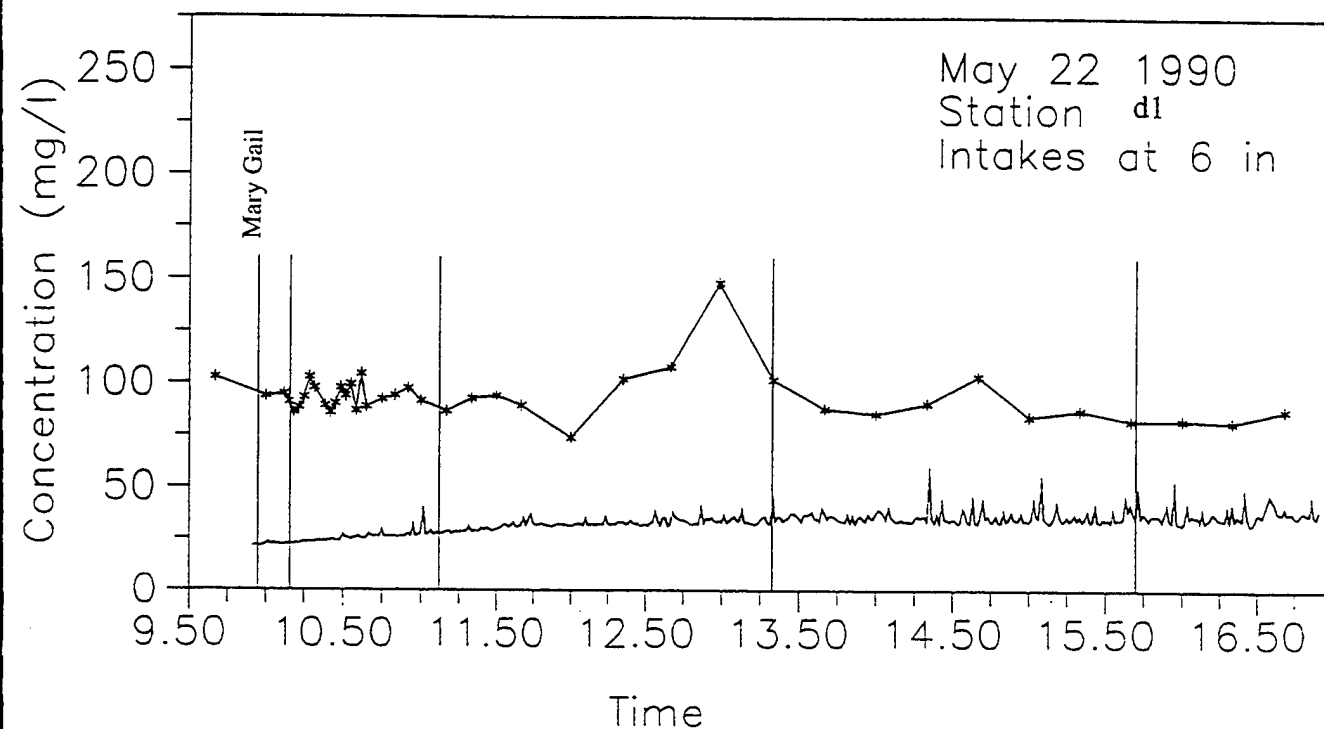
Stations a1 and b1 May 22, 1990



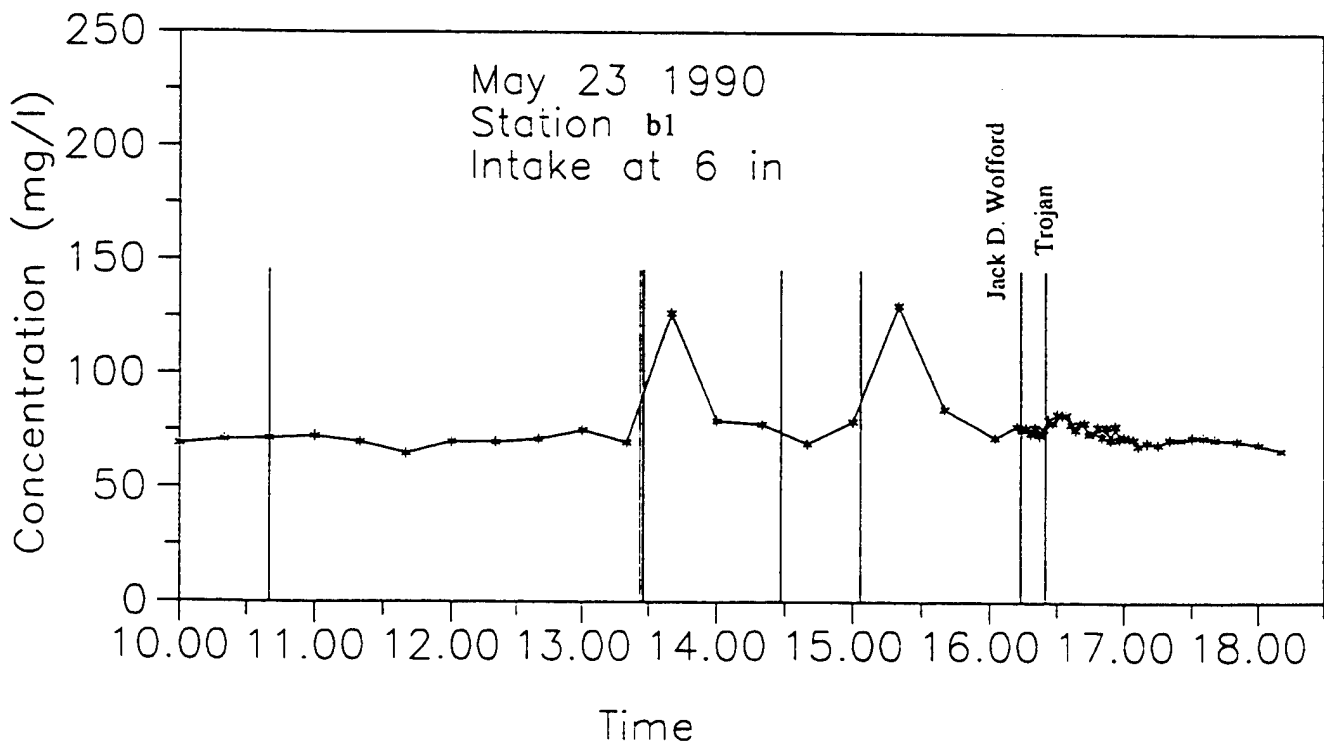
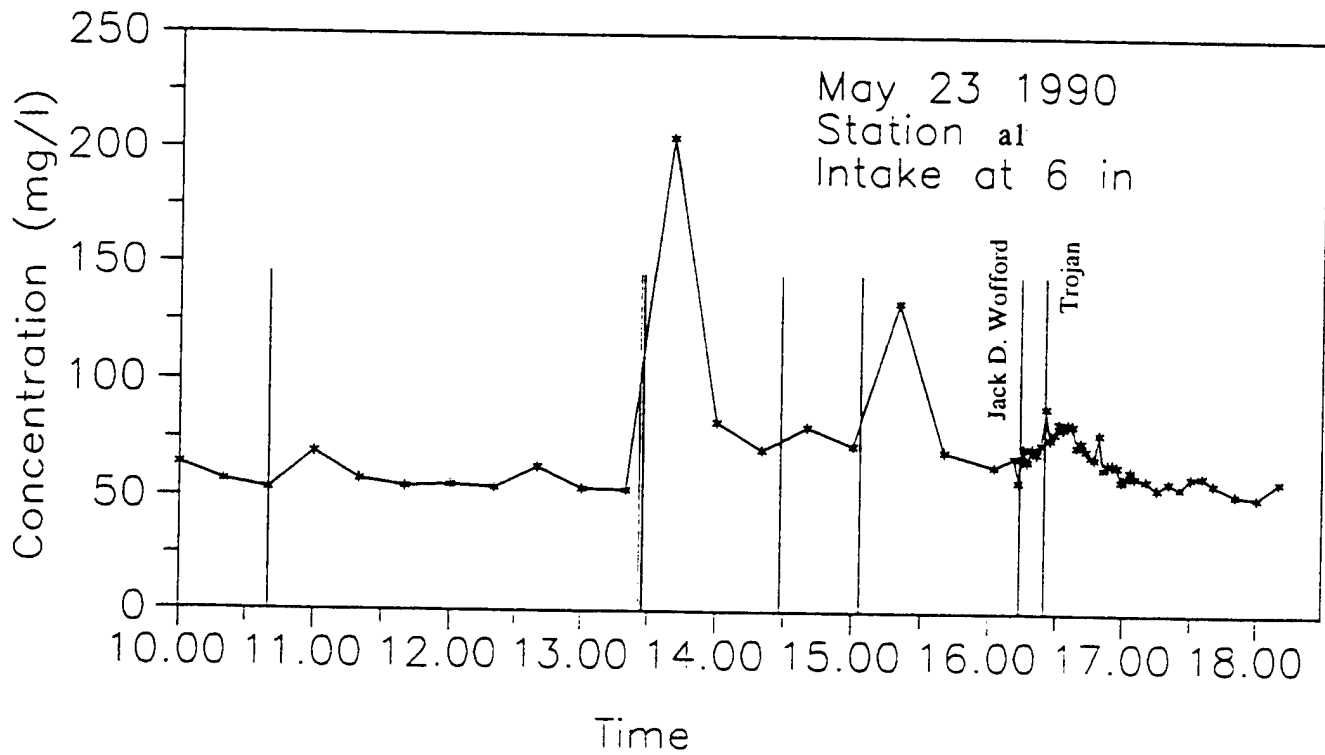
Stations c1 and c2 May 22, 1990



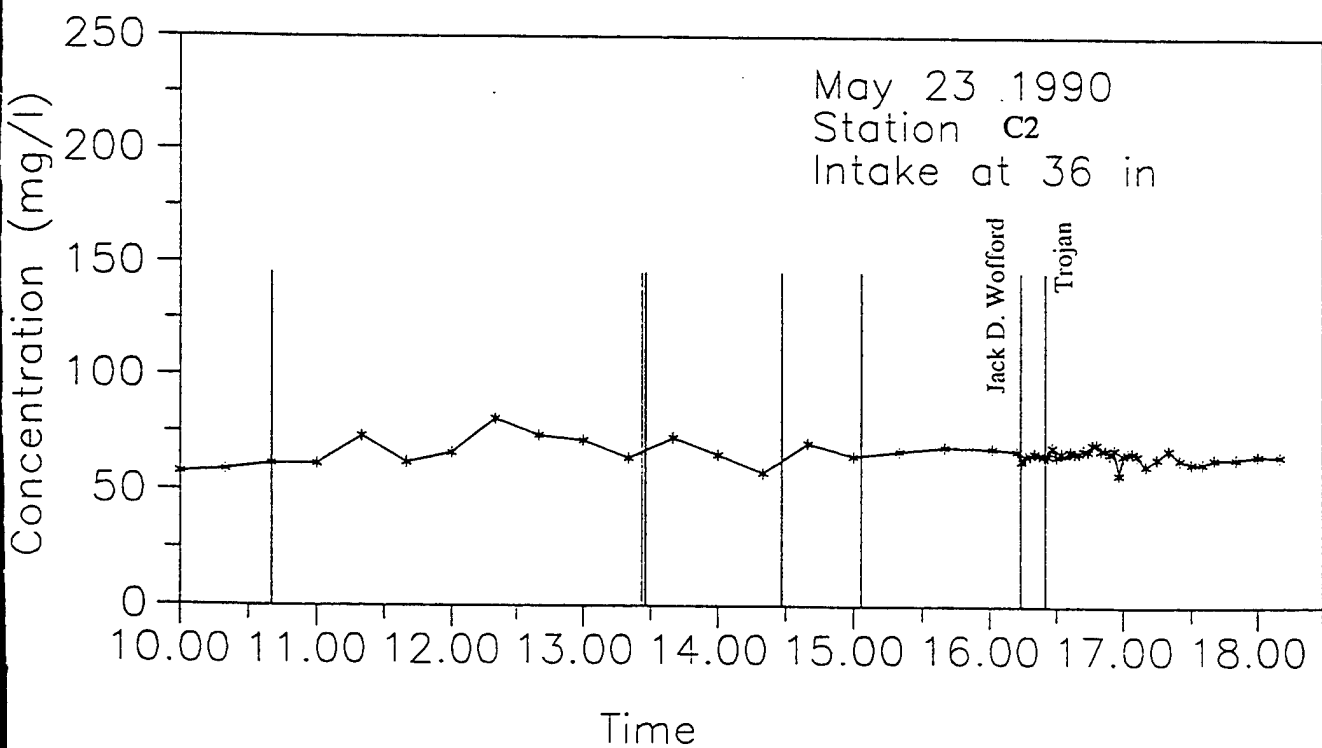
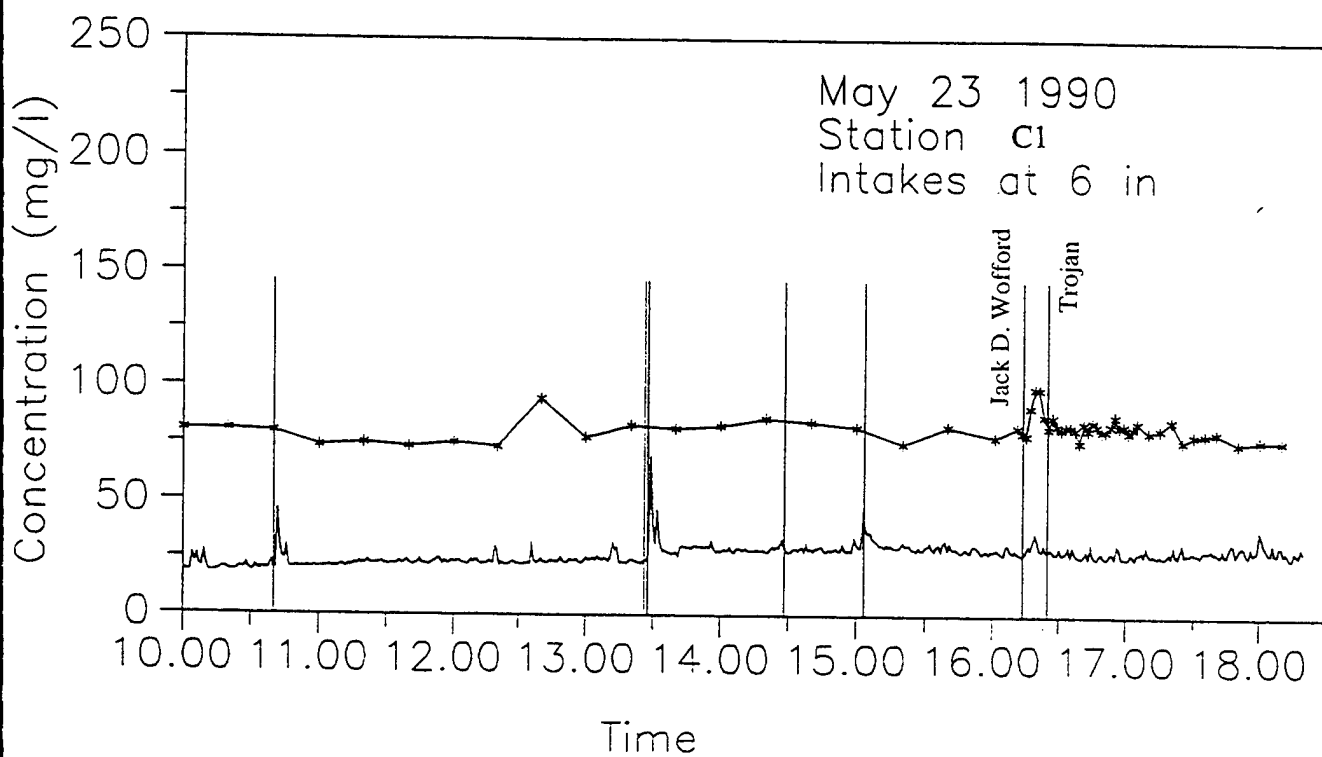
Stations d1 and d2 May 22, 1990



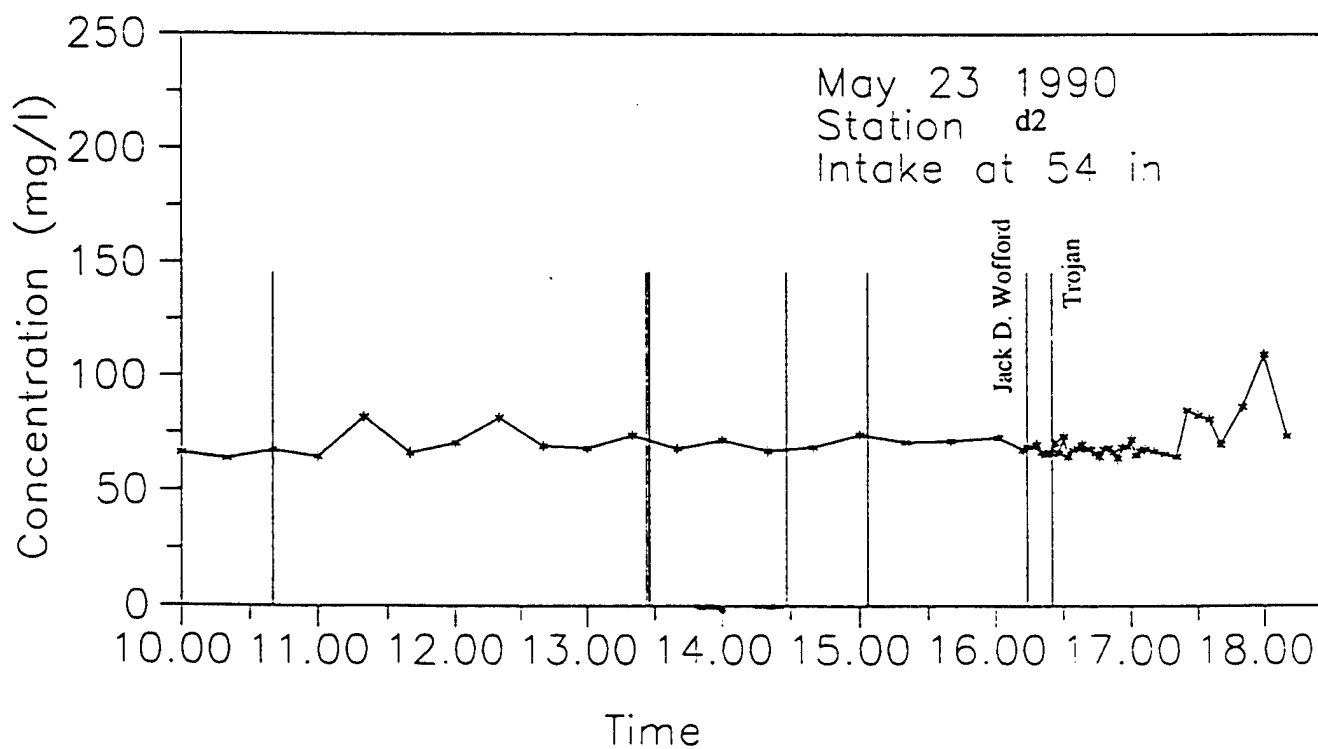
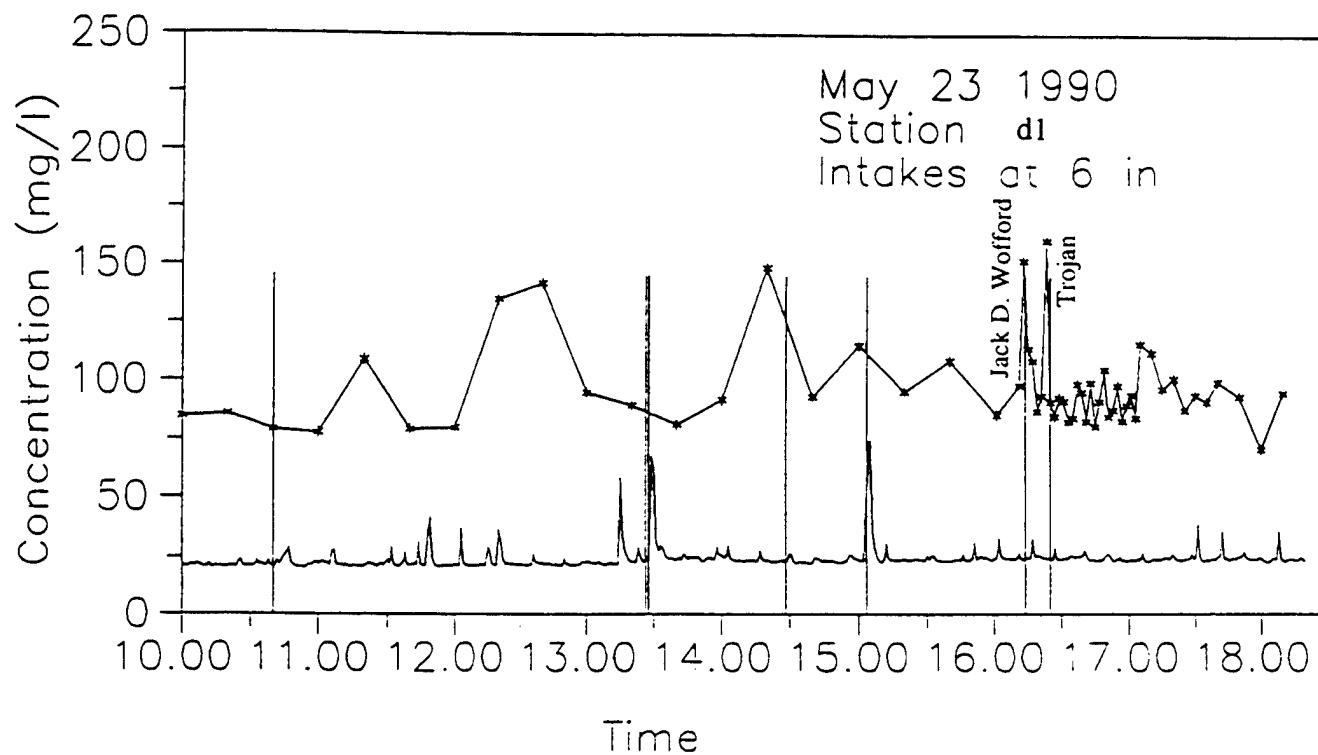
Stations a1 and b1 May 23, 1990



Stations c1 and c2 May 23, 1990

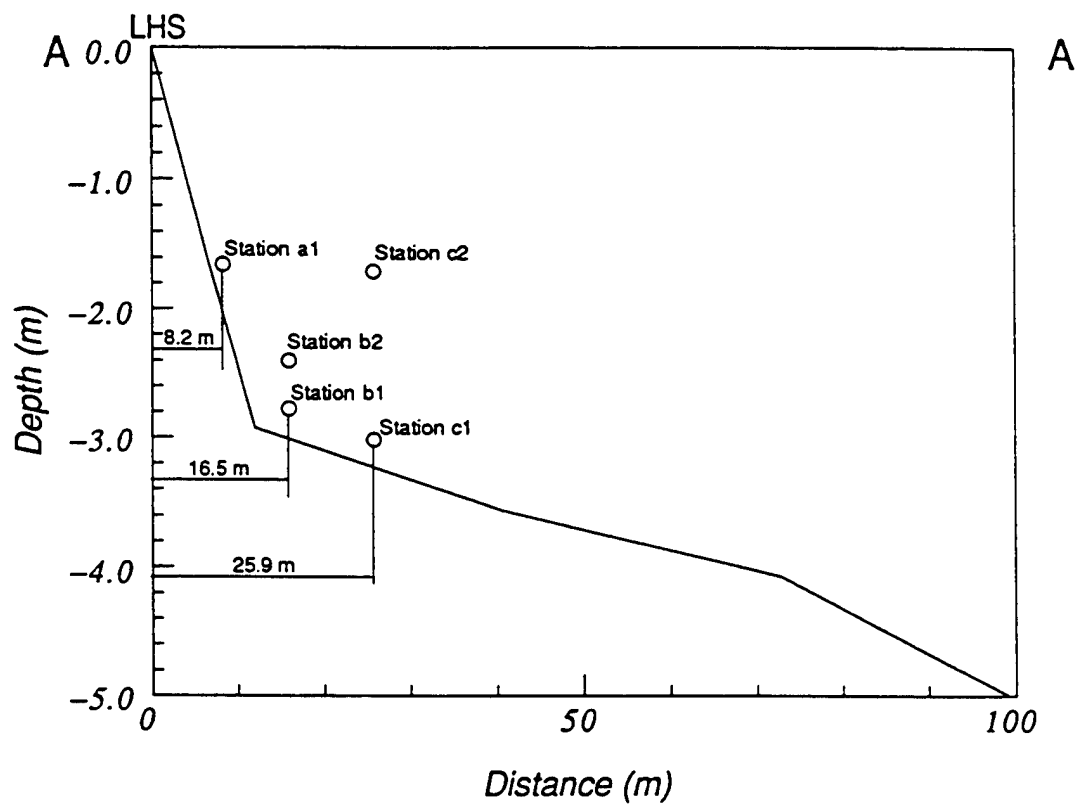


Stations d1 and d2 May 23, 1990

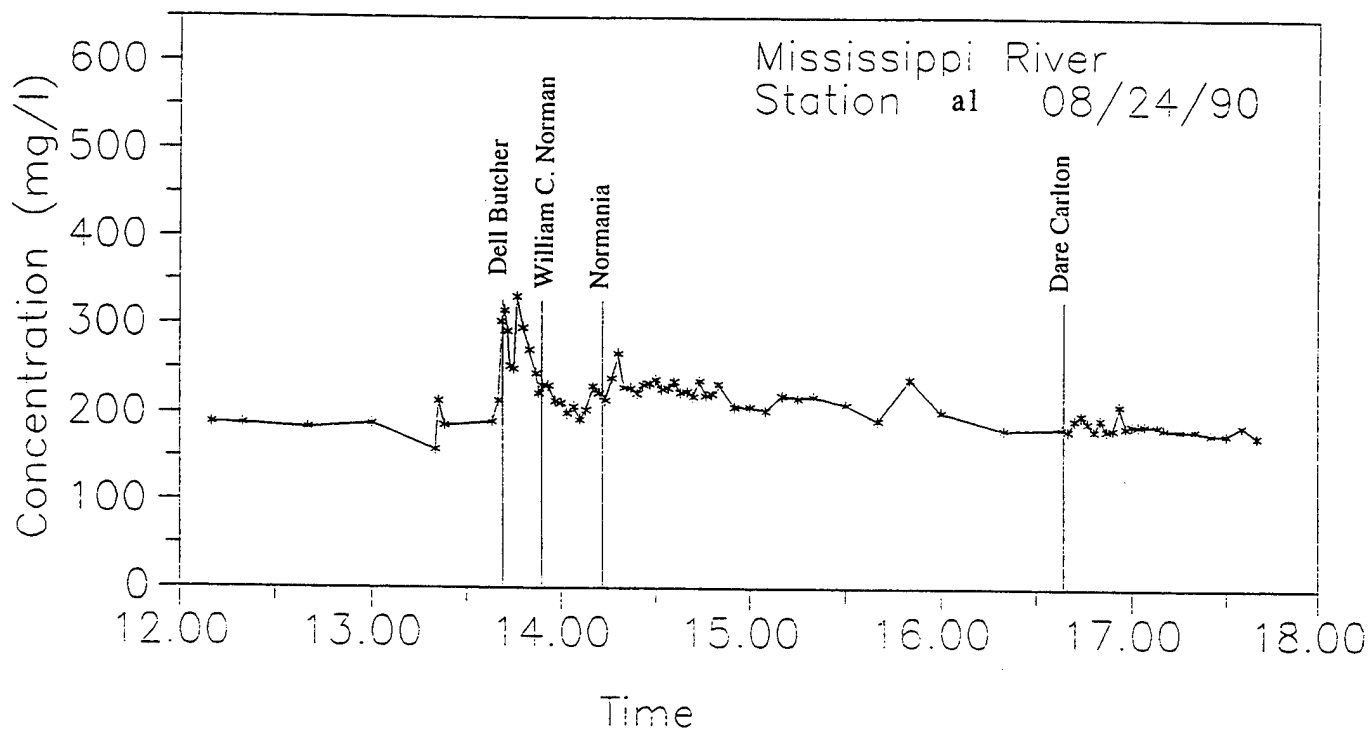


XXV-3. Variation of suspended sediment concentration with time, Goose Island, trip 1

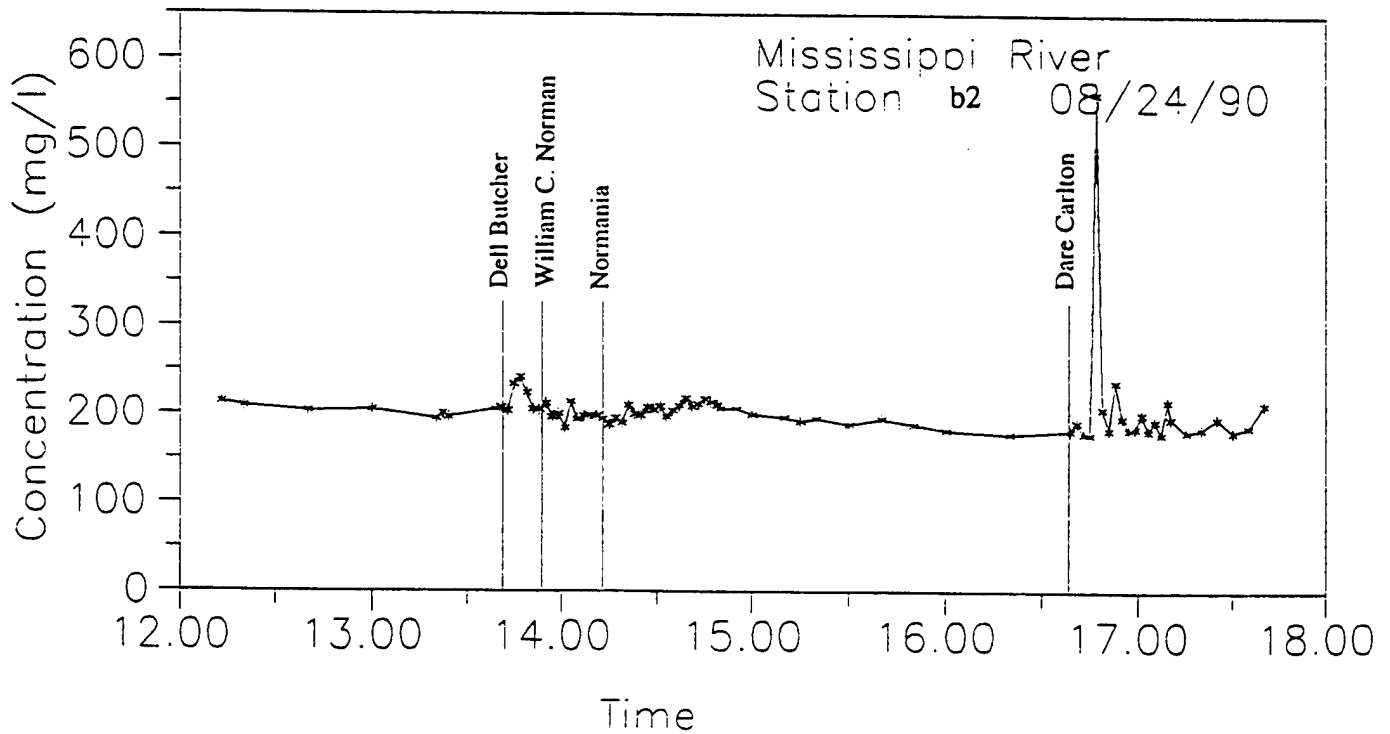
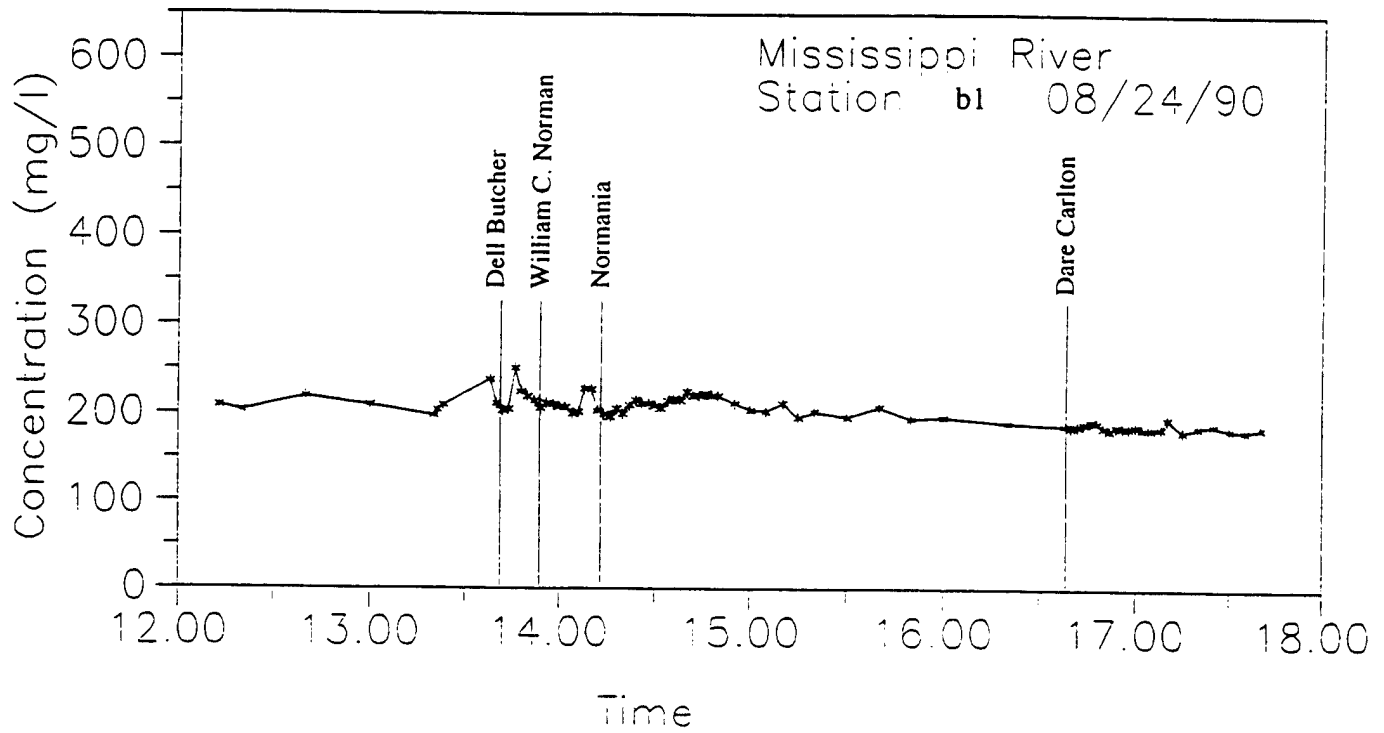
Location of suspended sediment sampling stations on the Mississippi River
near the Goose Island site during August 20-29, 1990 (trip 1)



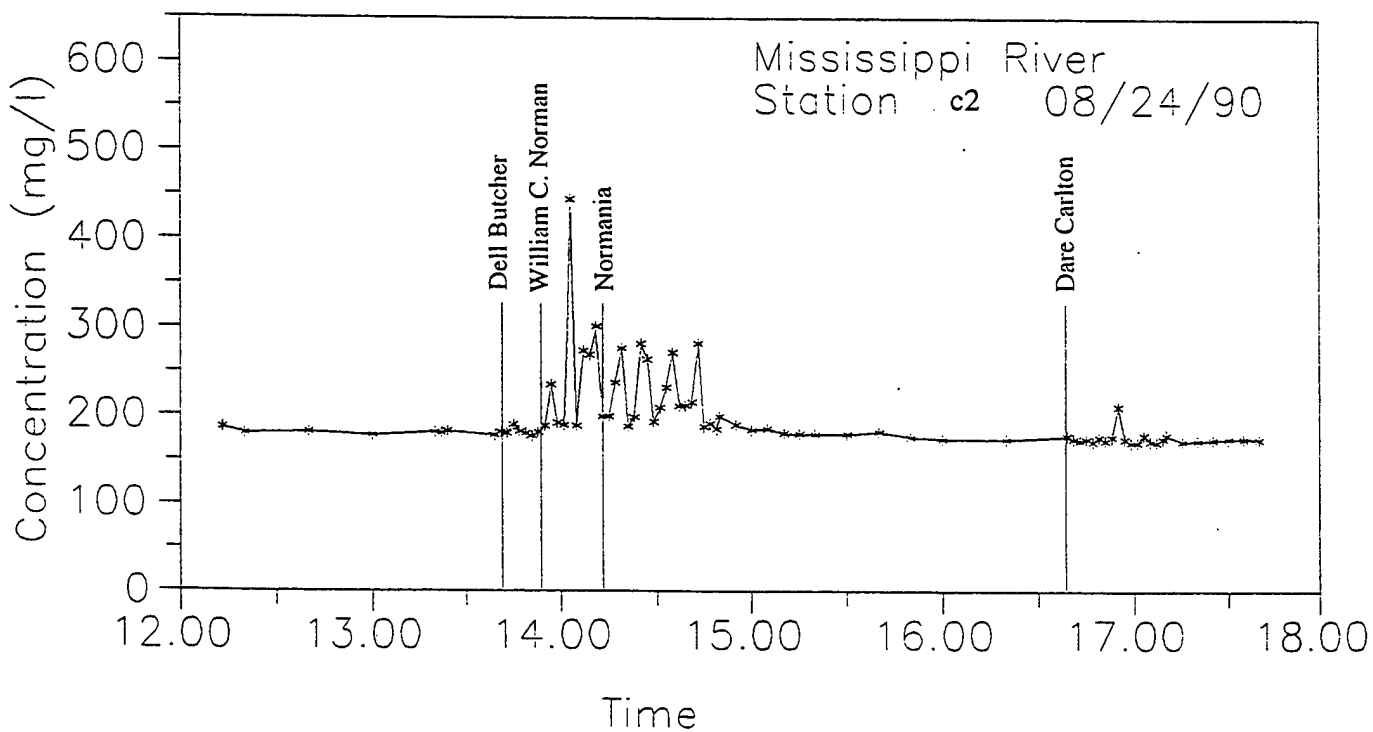
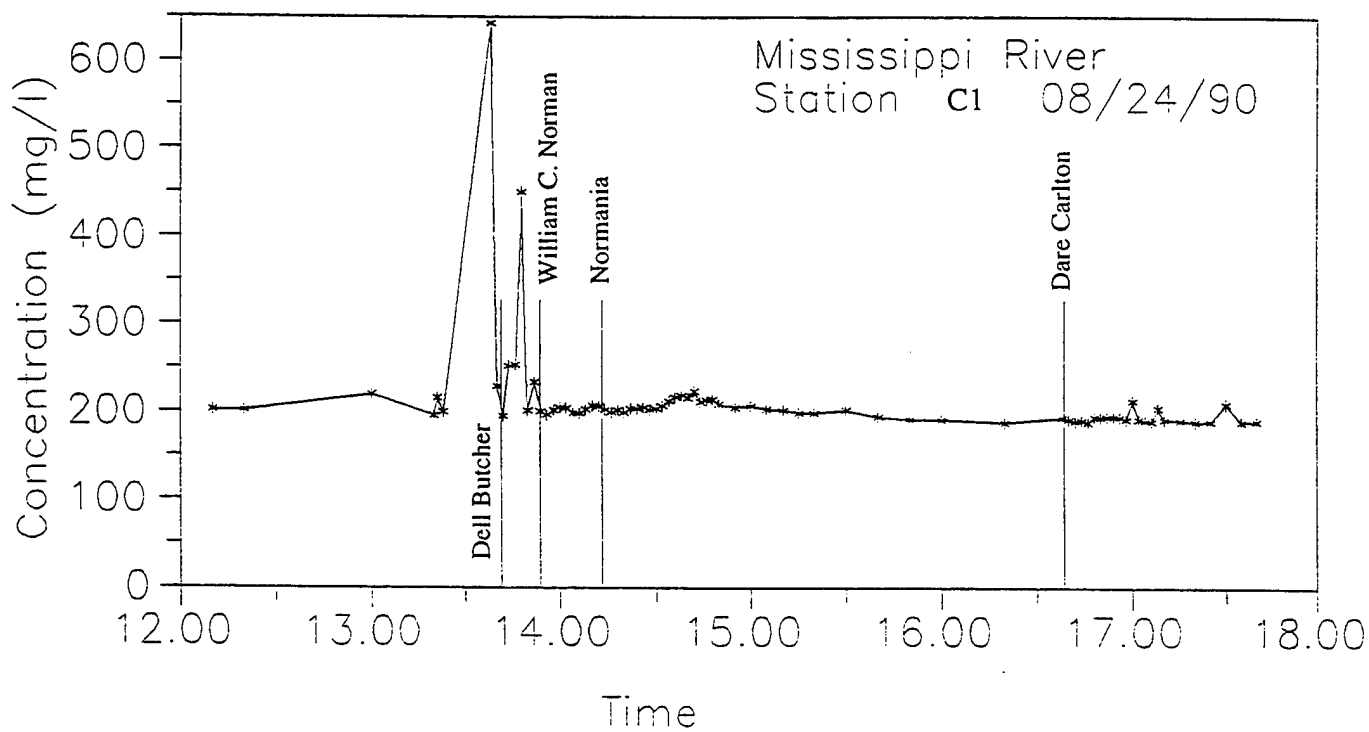
Station a1 August 24, 1990



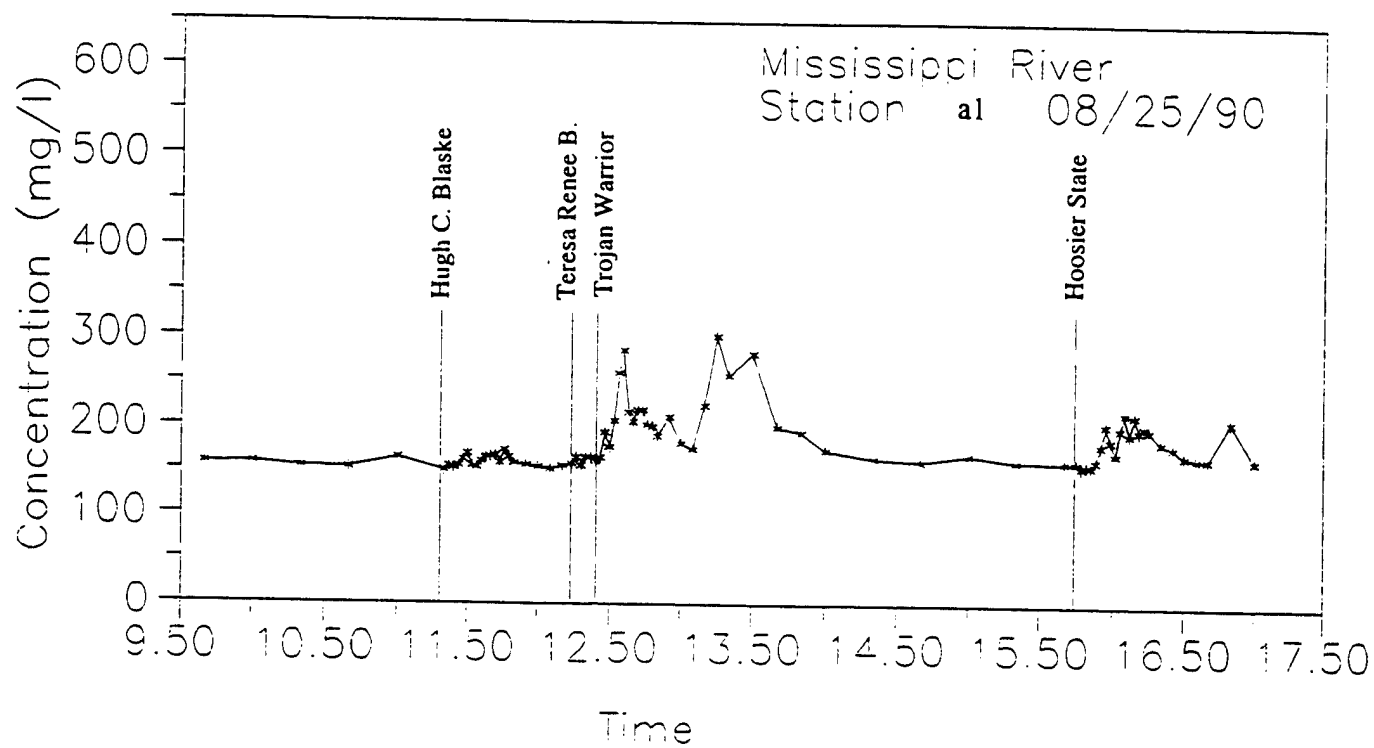
Stations b1 and b2 August 24, 1990



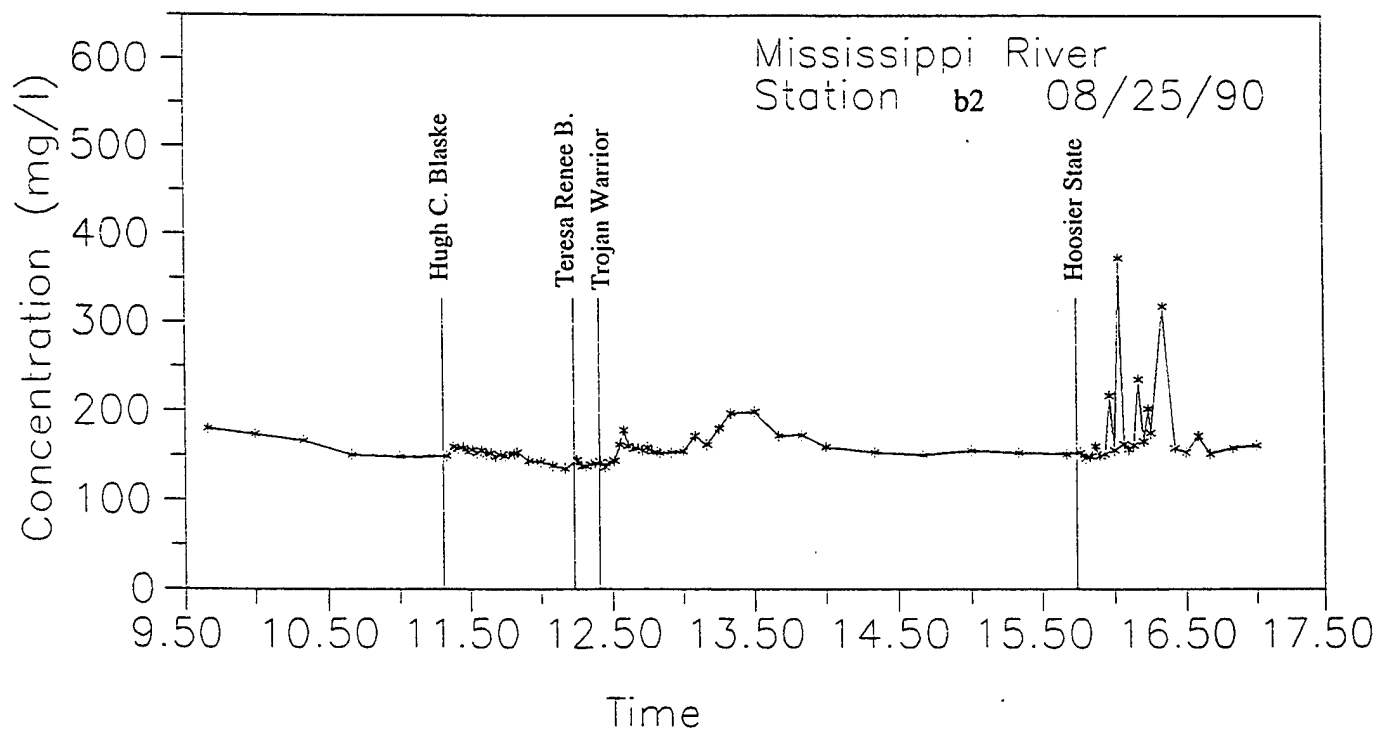
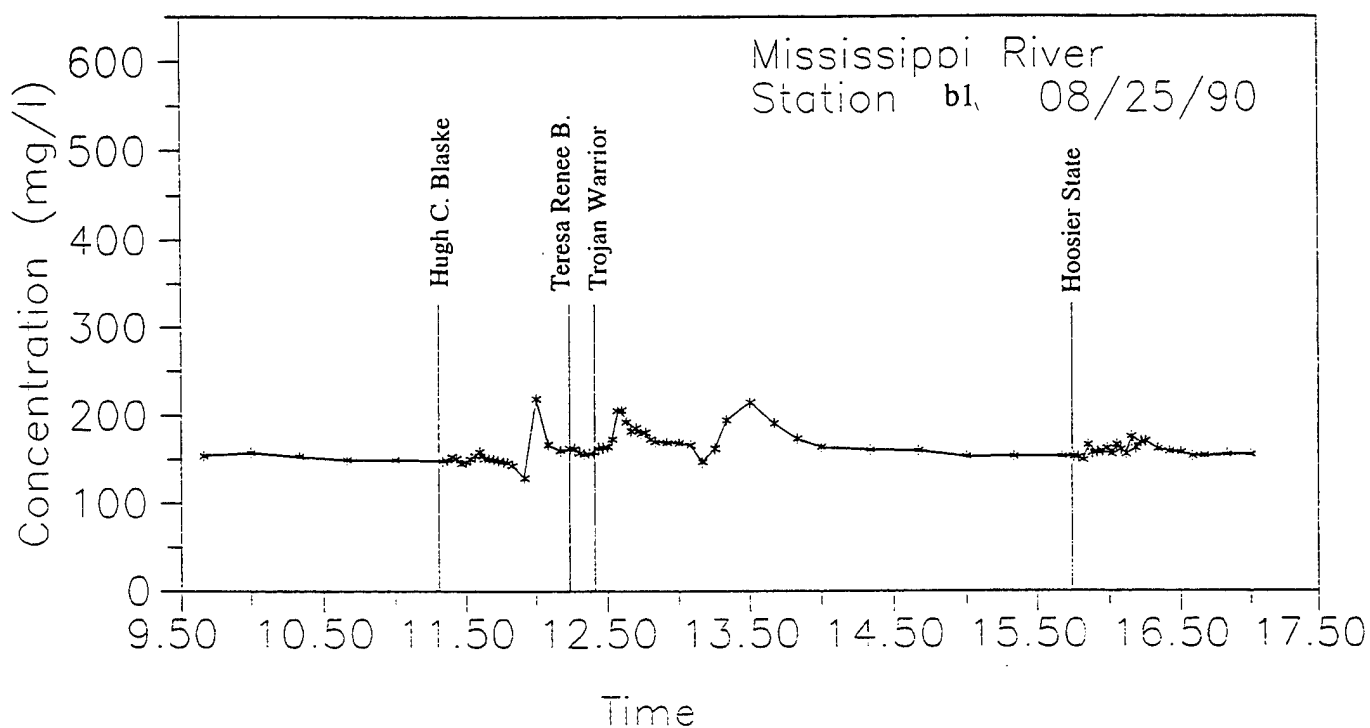
Stations c1 and c2 August 24, 1990



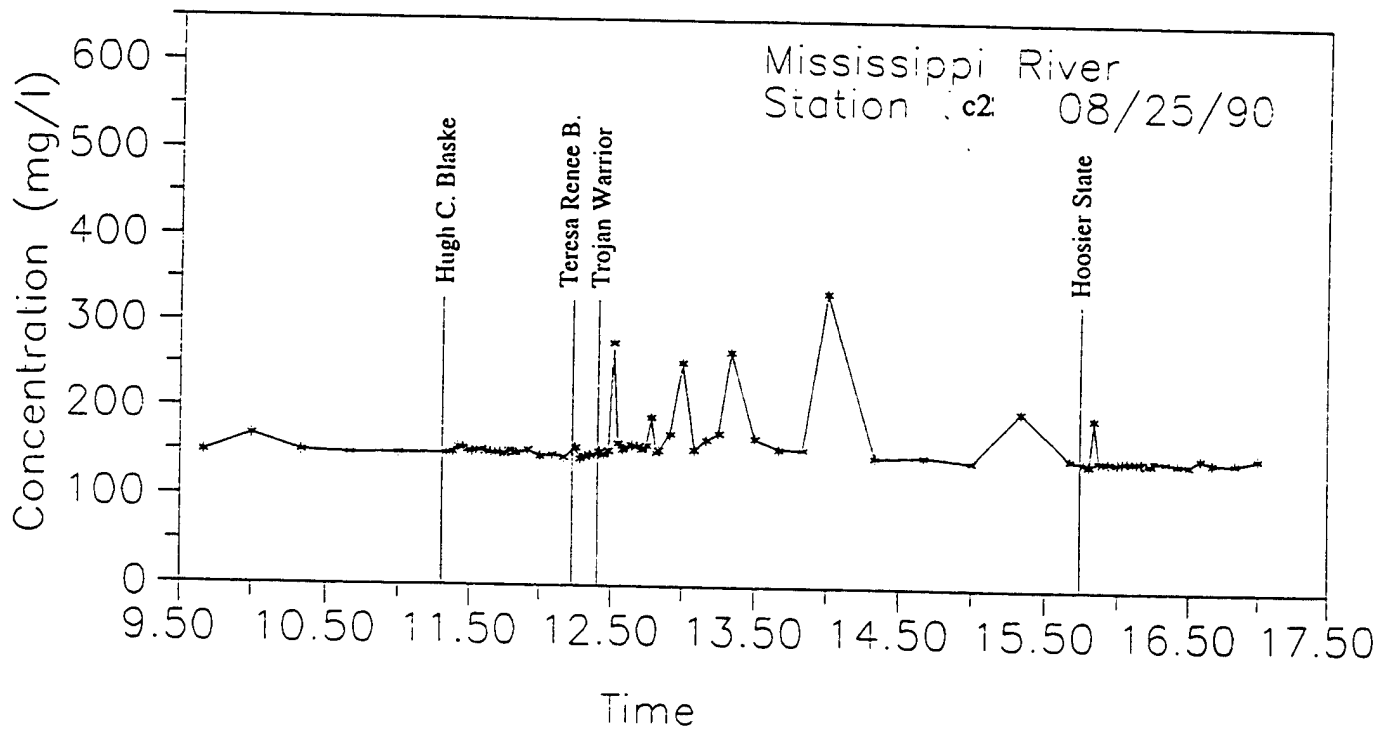
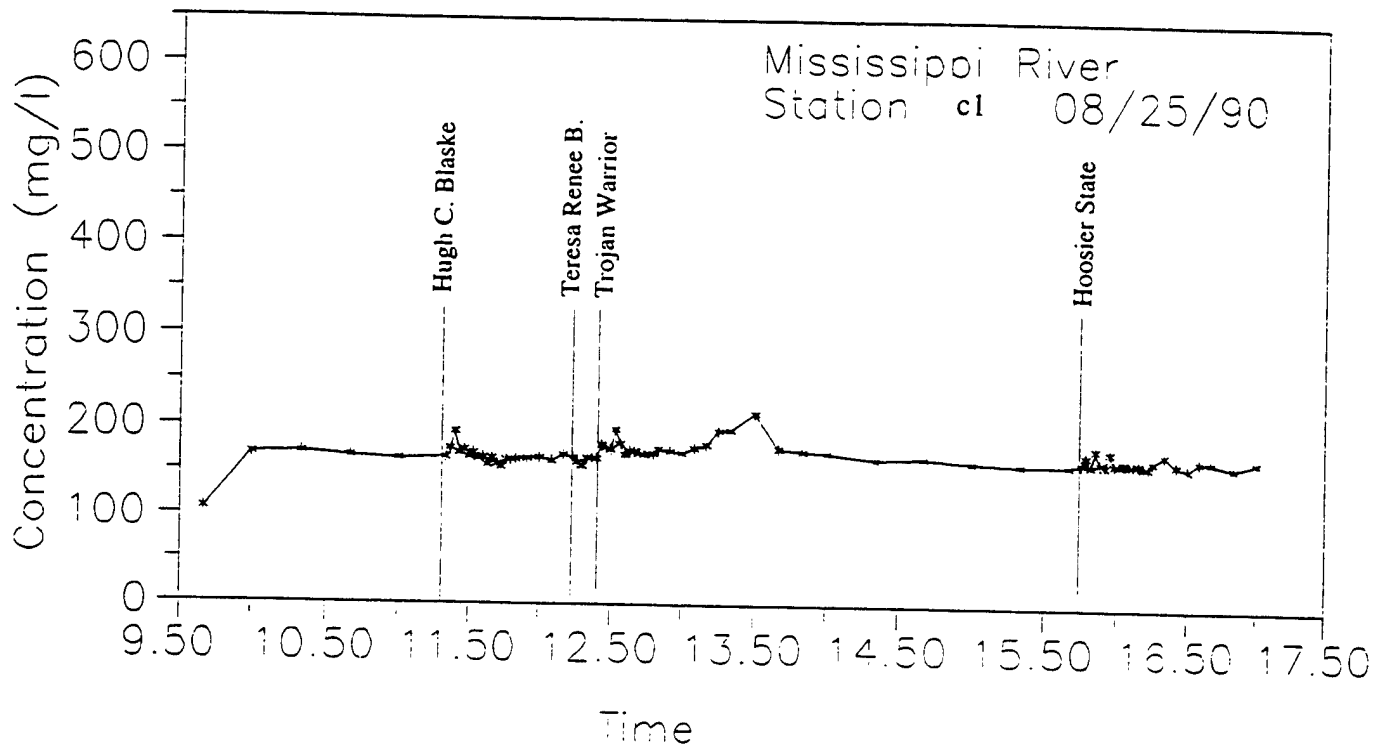
Station a1 August 25, 1990



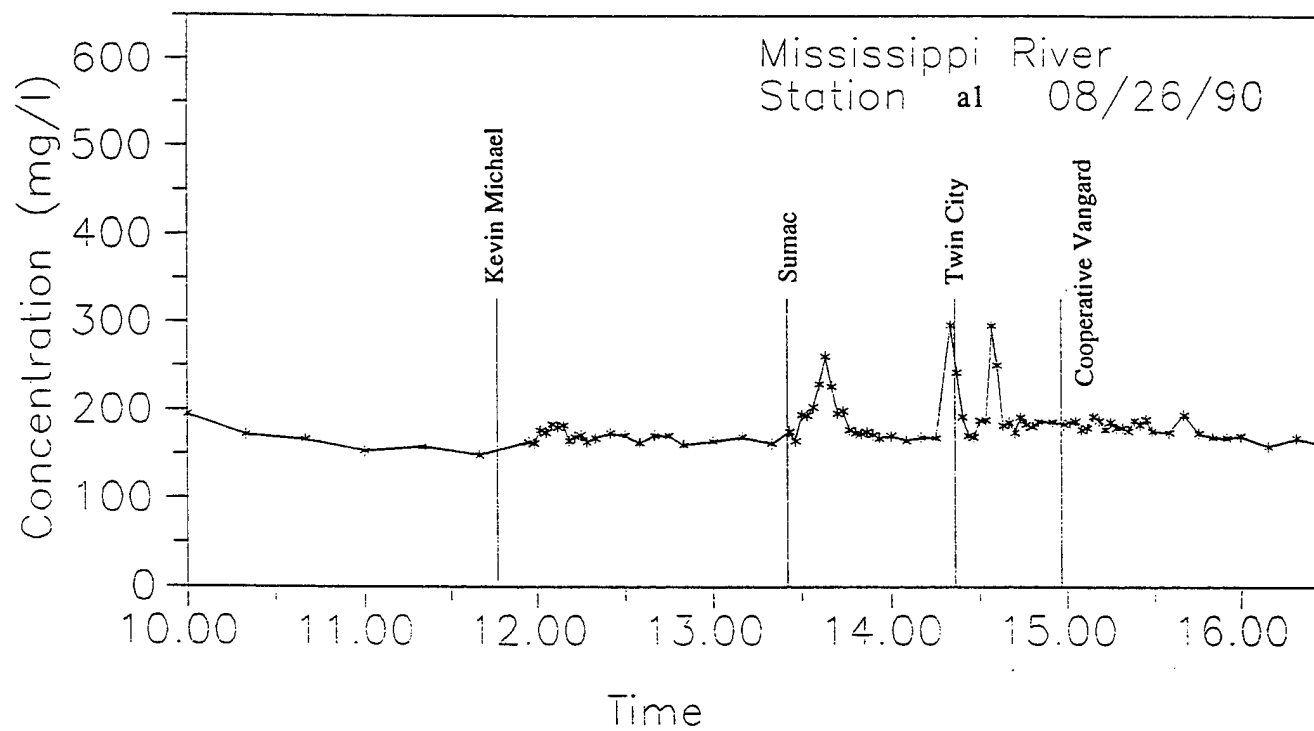
Stations b1 and b2 August 25, 1990



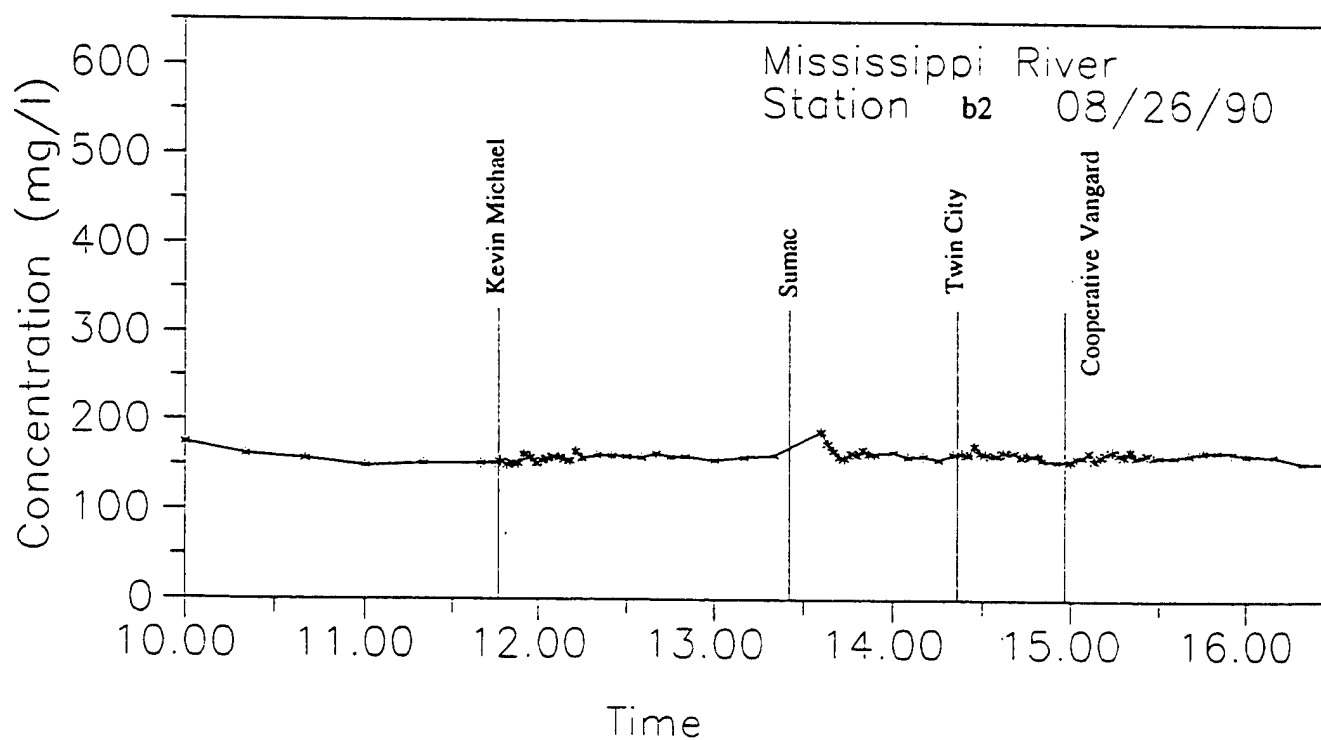
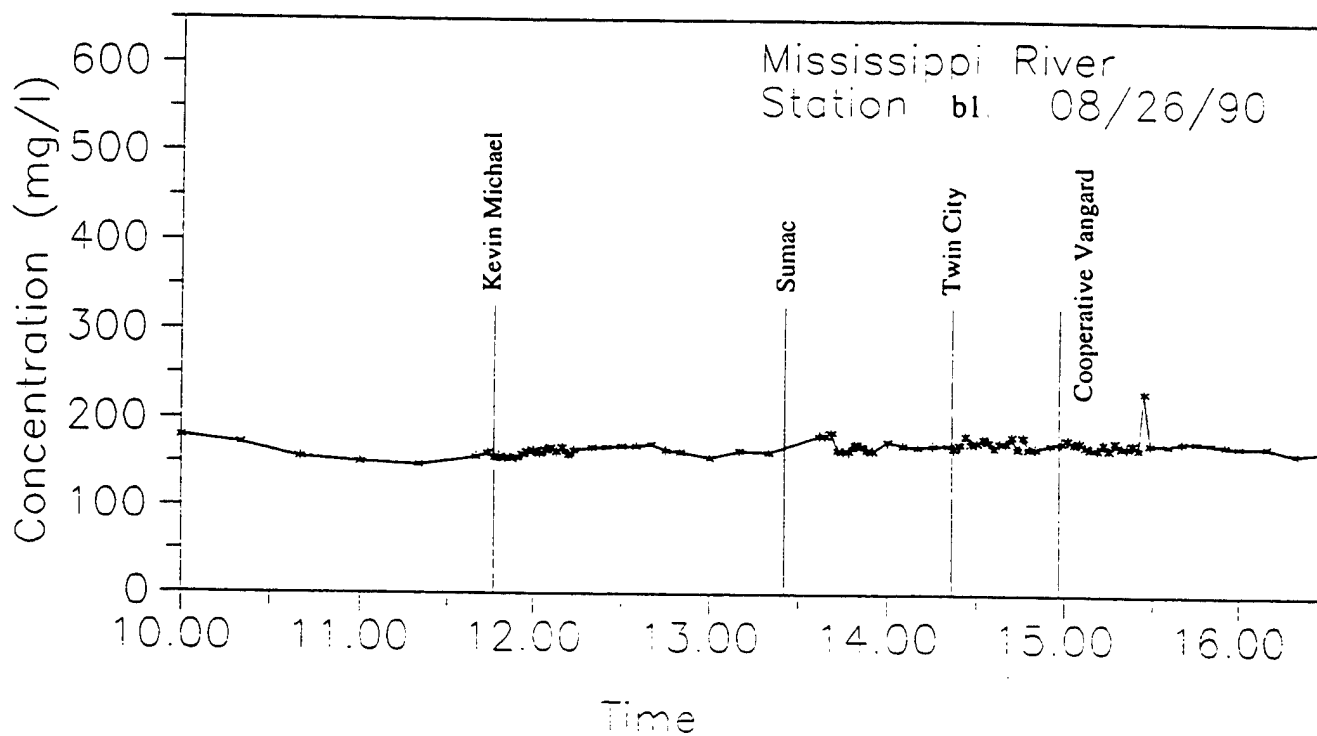
Stations c1 and c2 August 25, 1990



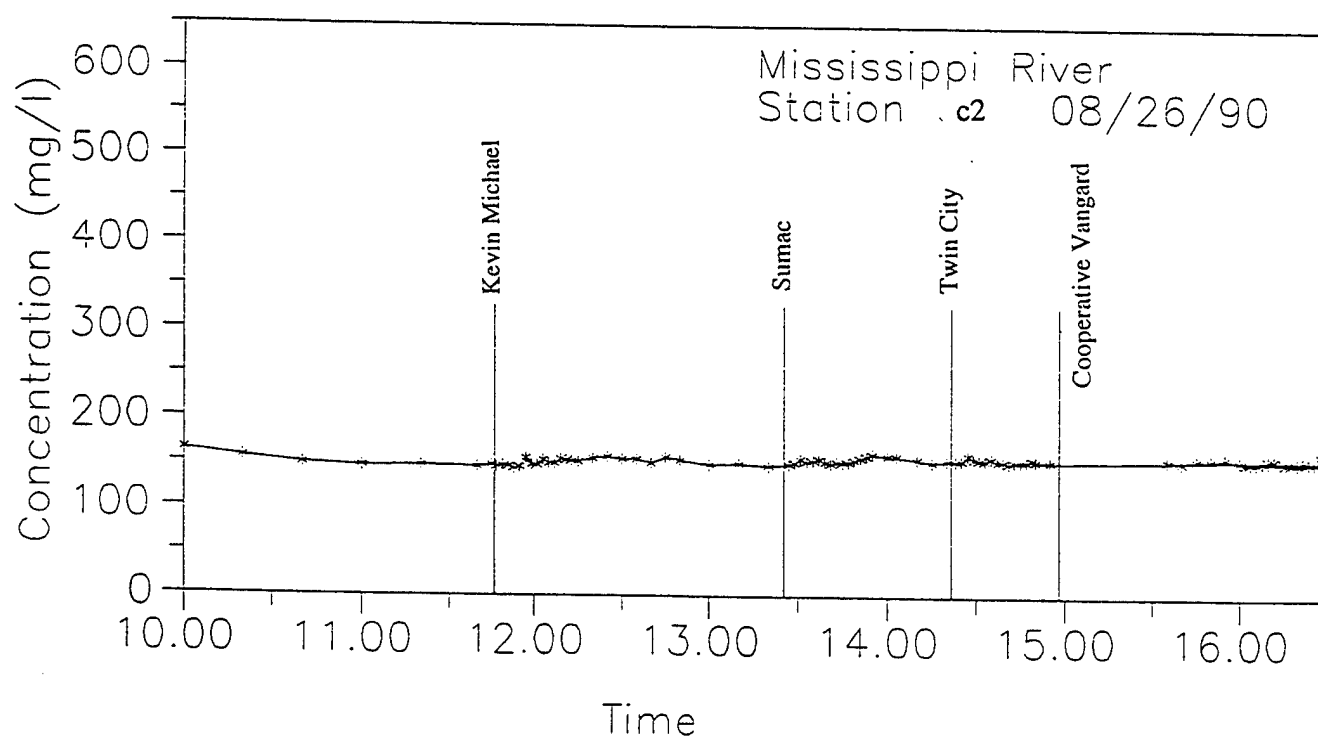
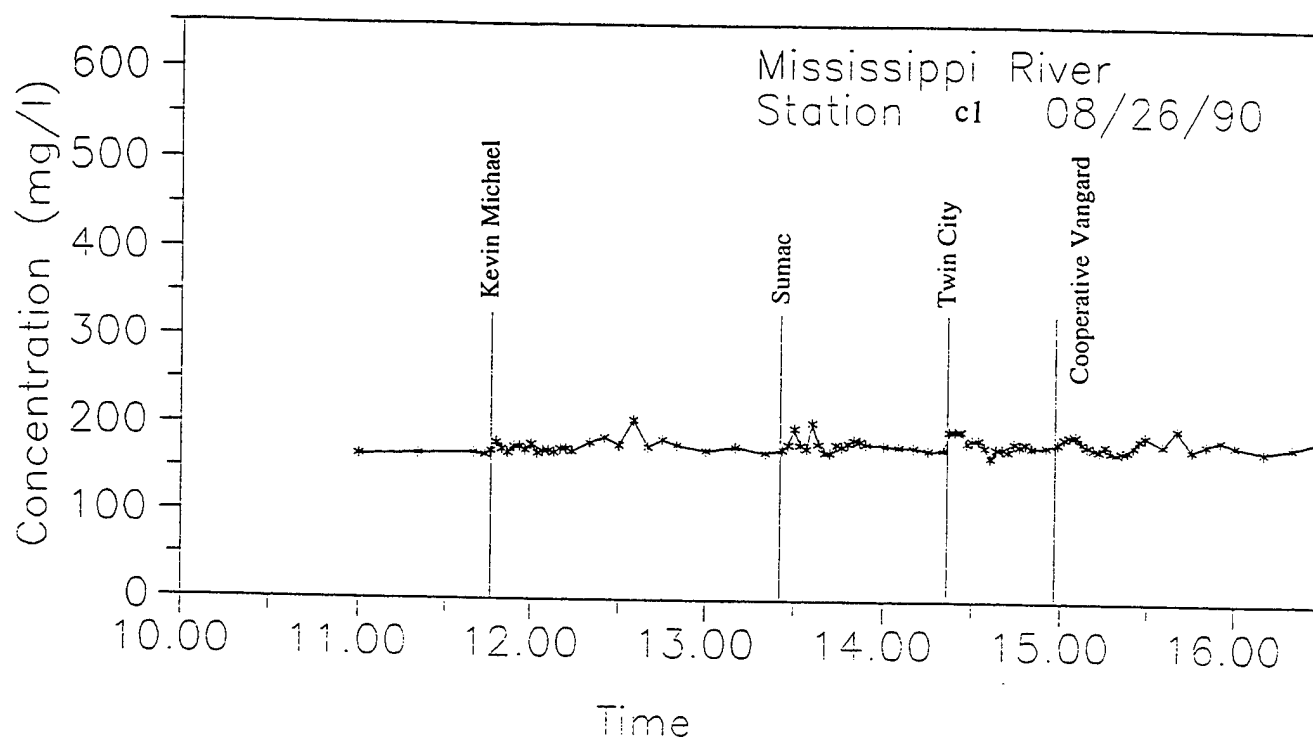
Station a1 August 26, 1990



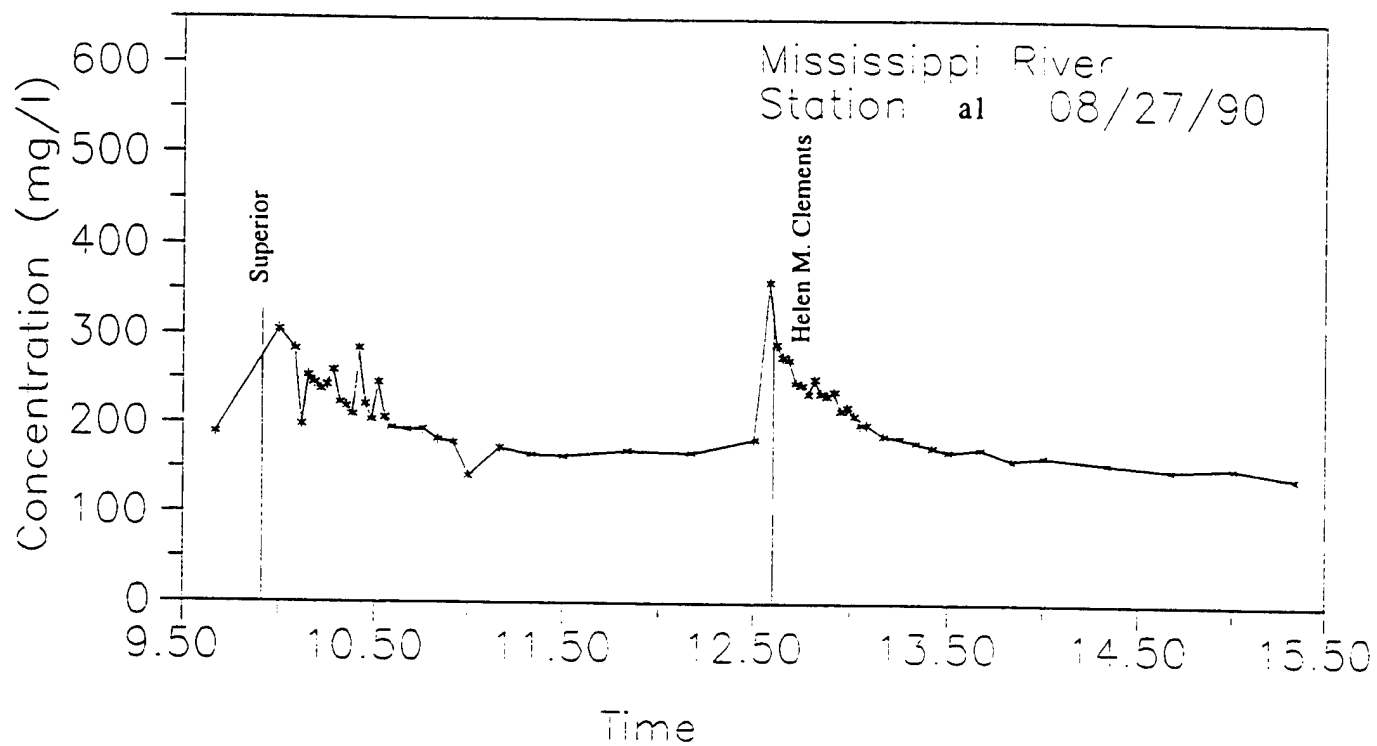
Stations b1 and b2 August 26, 1990



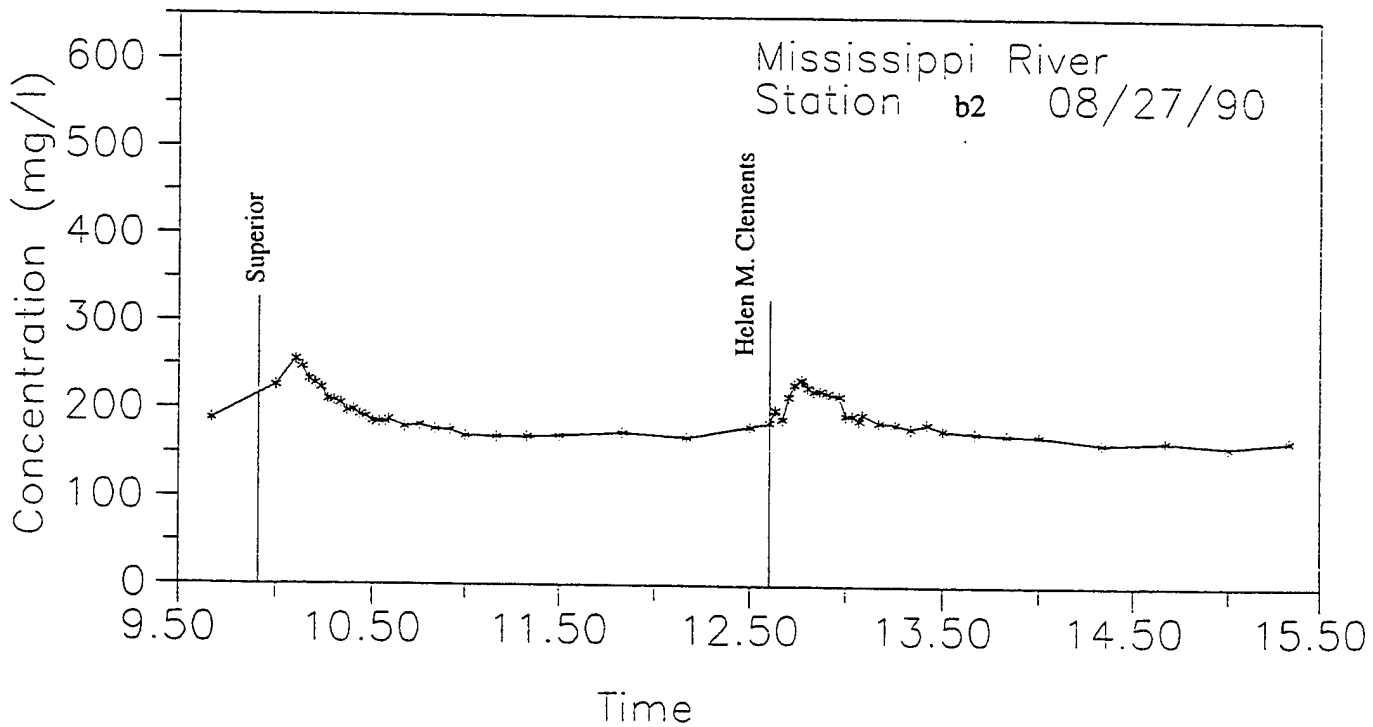
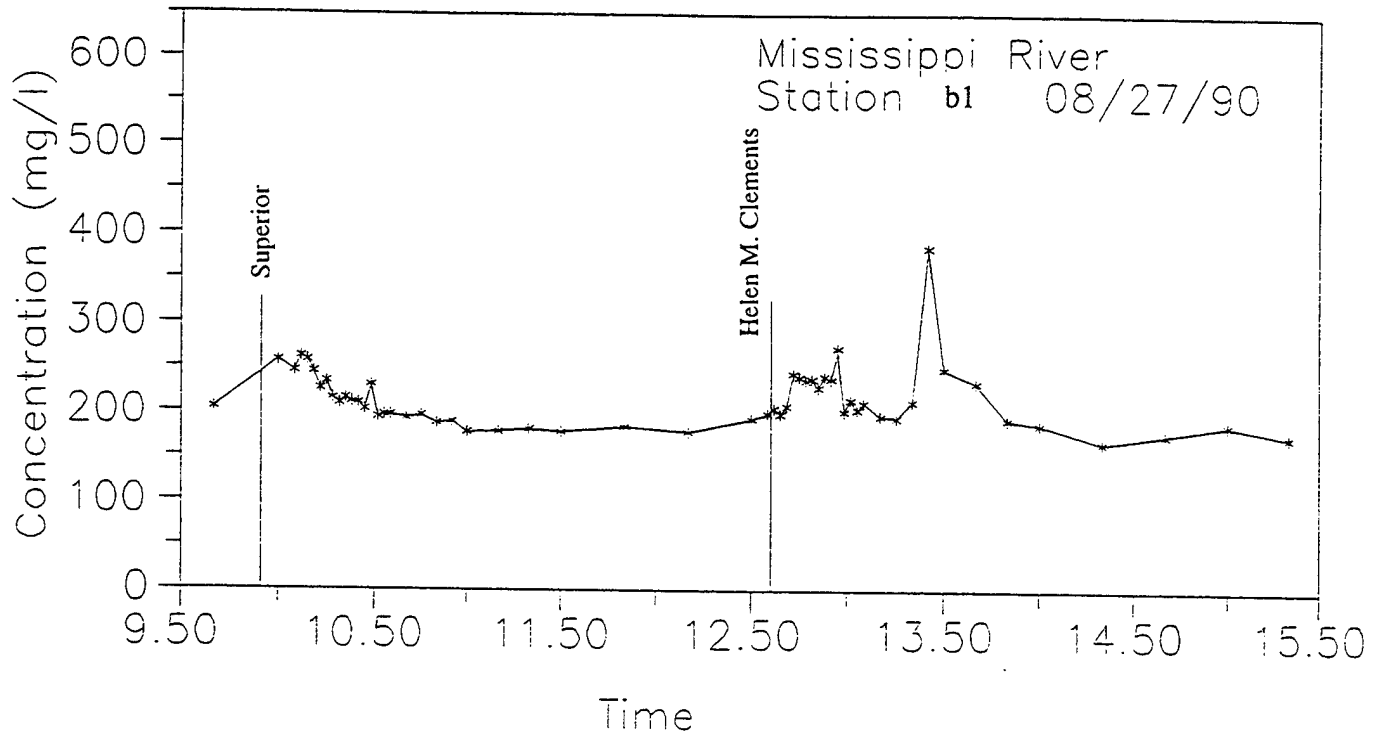
Stations c1 and c2 August 26, 1990



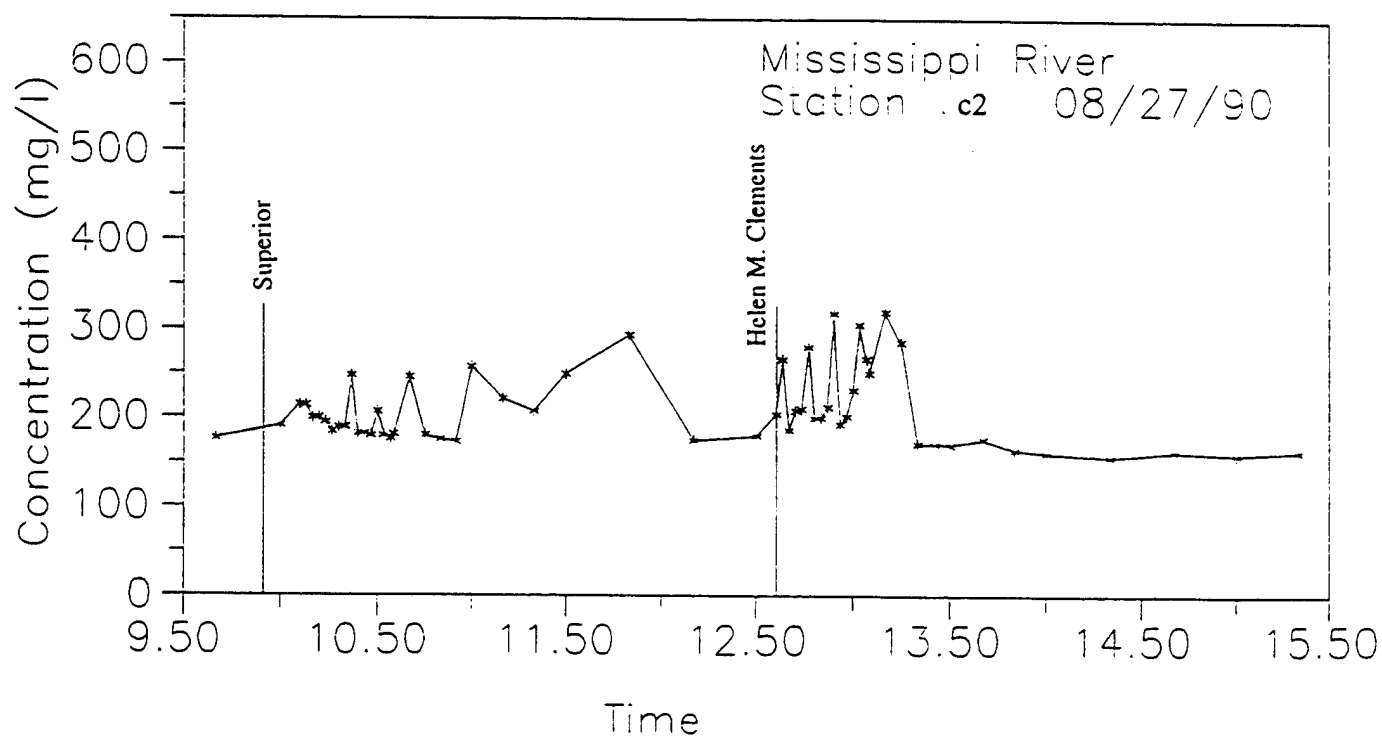
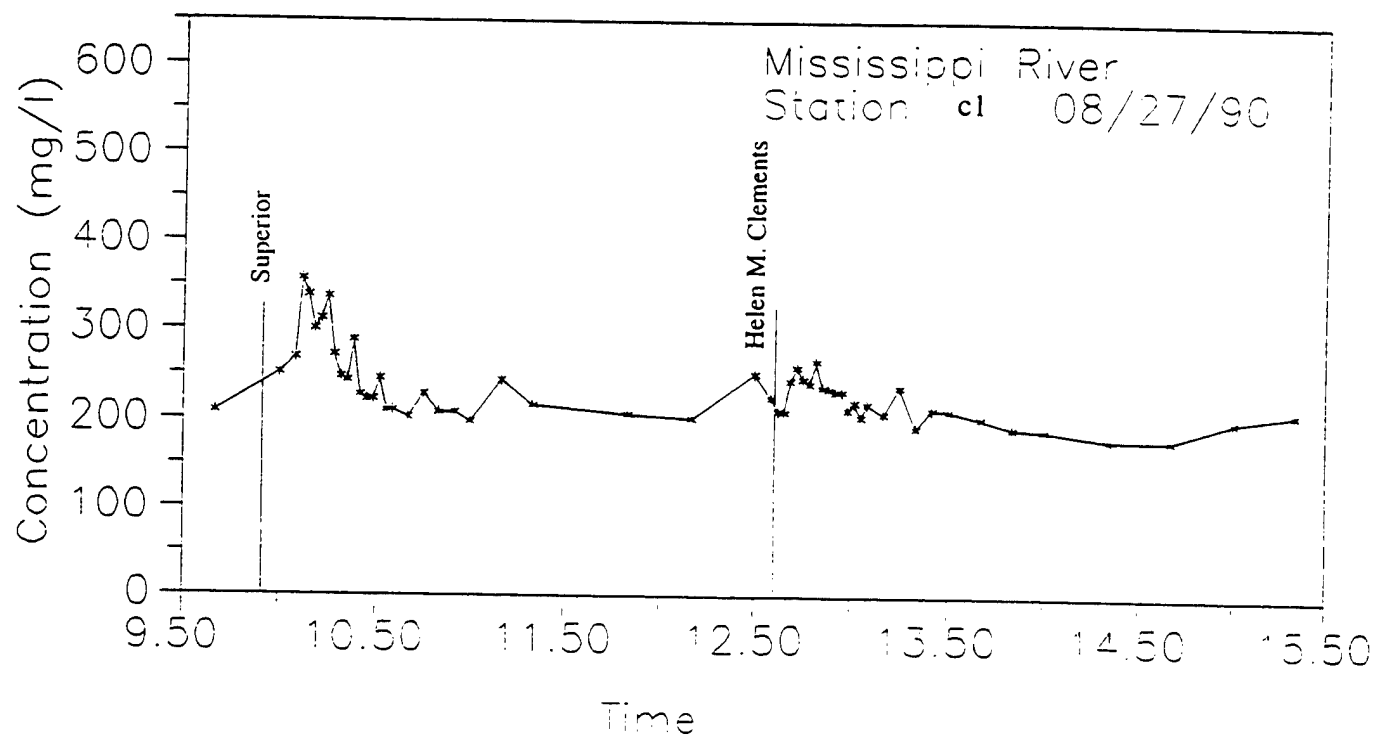
Station a1 August 27, 1990



Stations b1 and b2 August 27, 1990

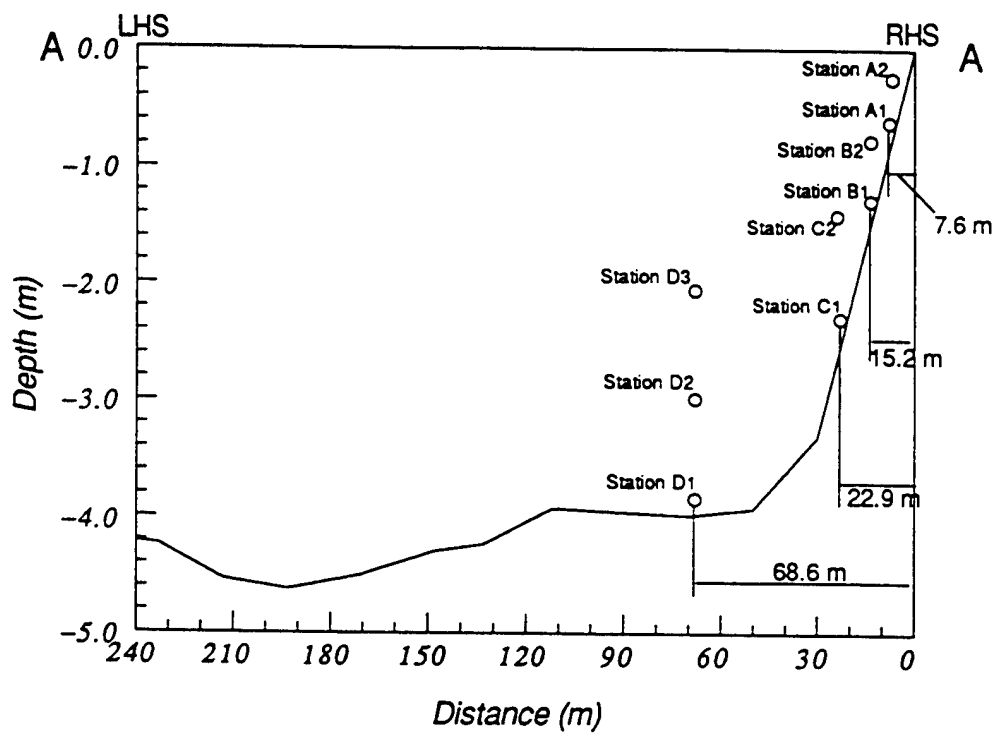


Stations c1 and c2 August 27, 1990

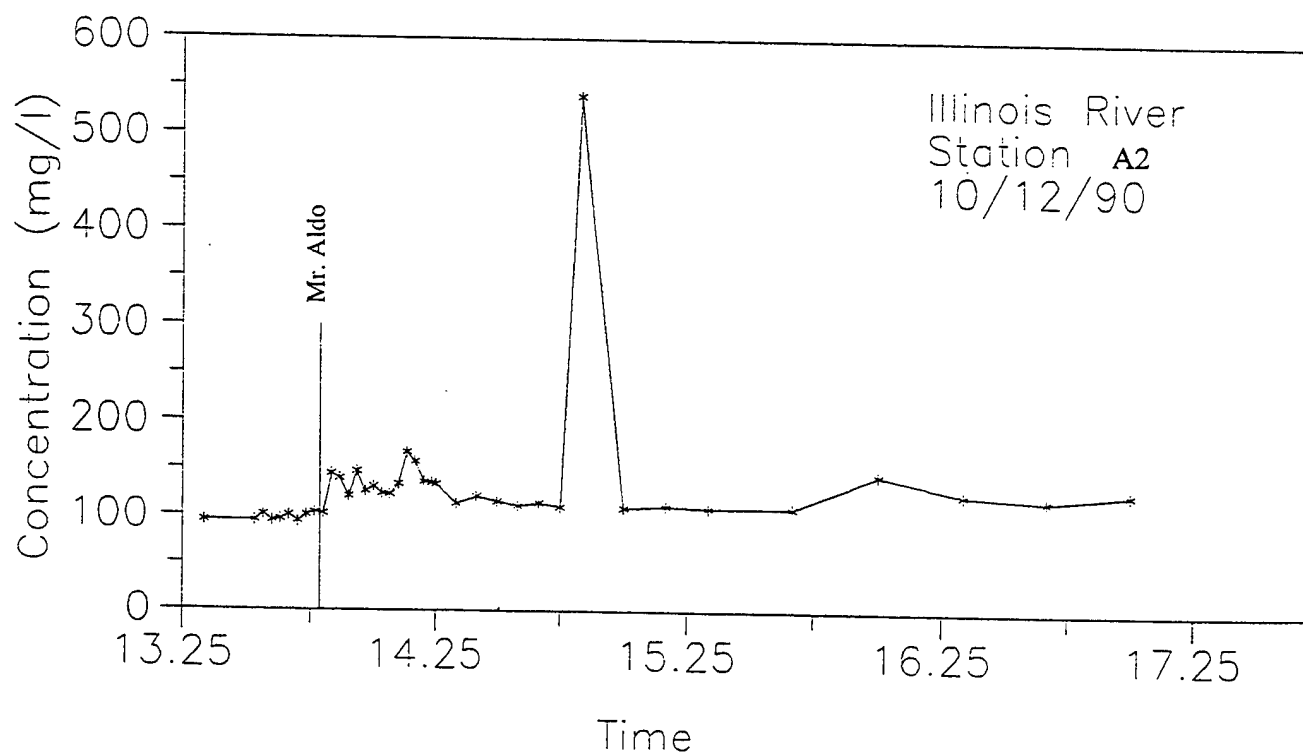
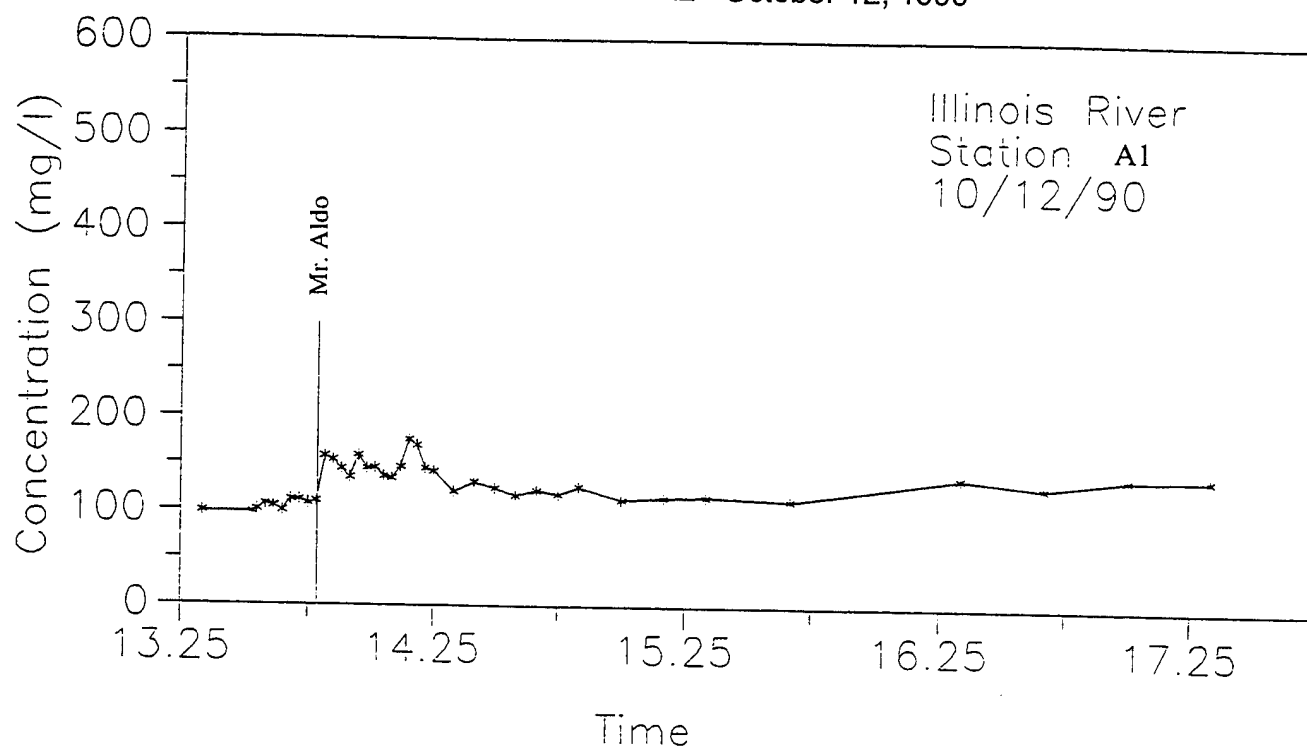


XXV-4. Variation of suspended sediment concentration with time, Kampsville, trip 1

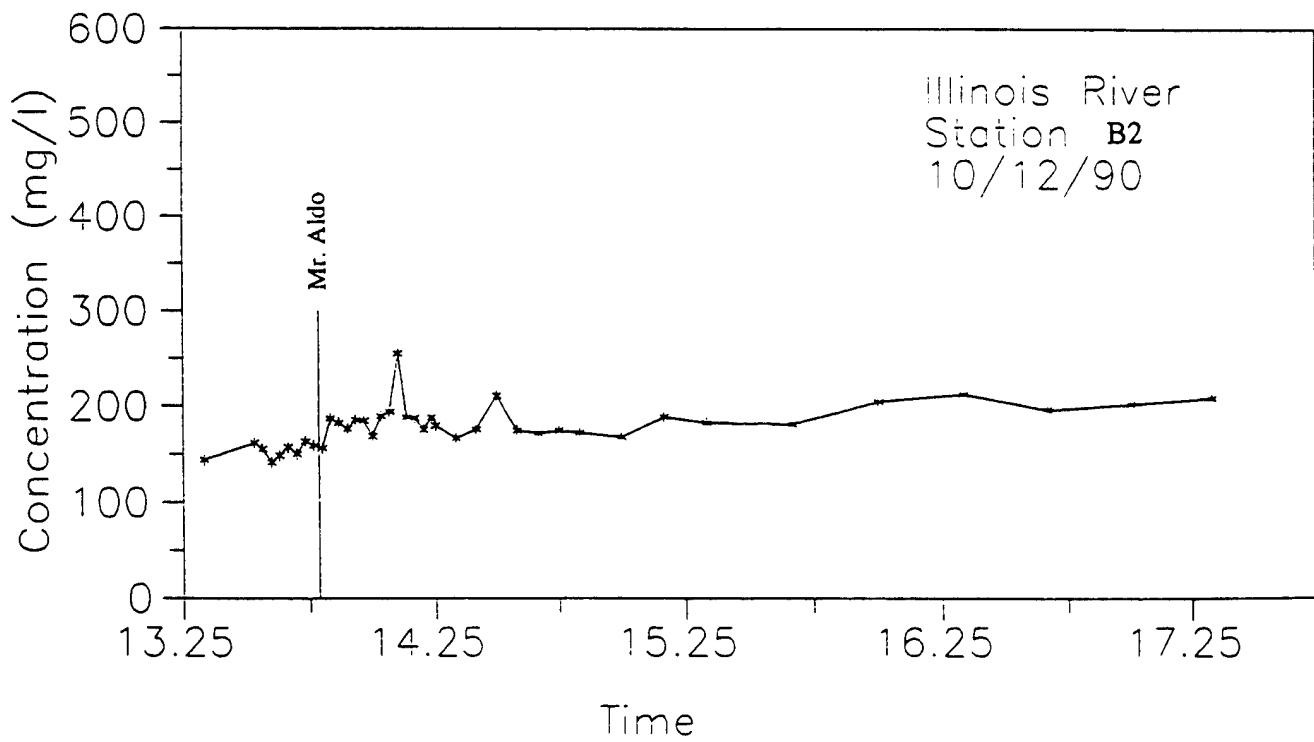
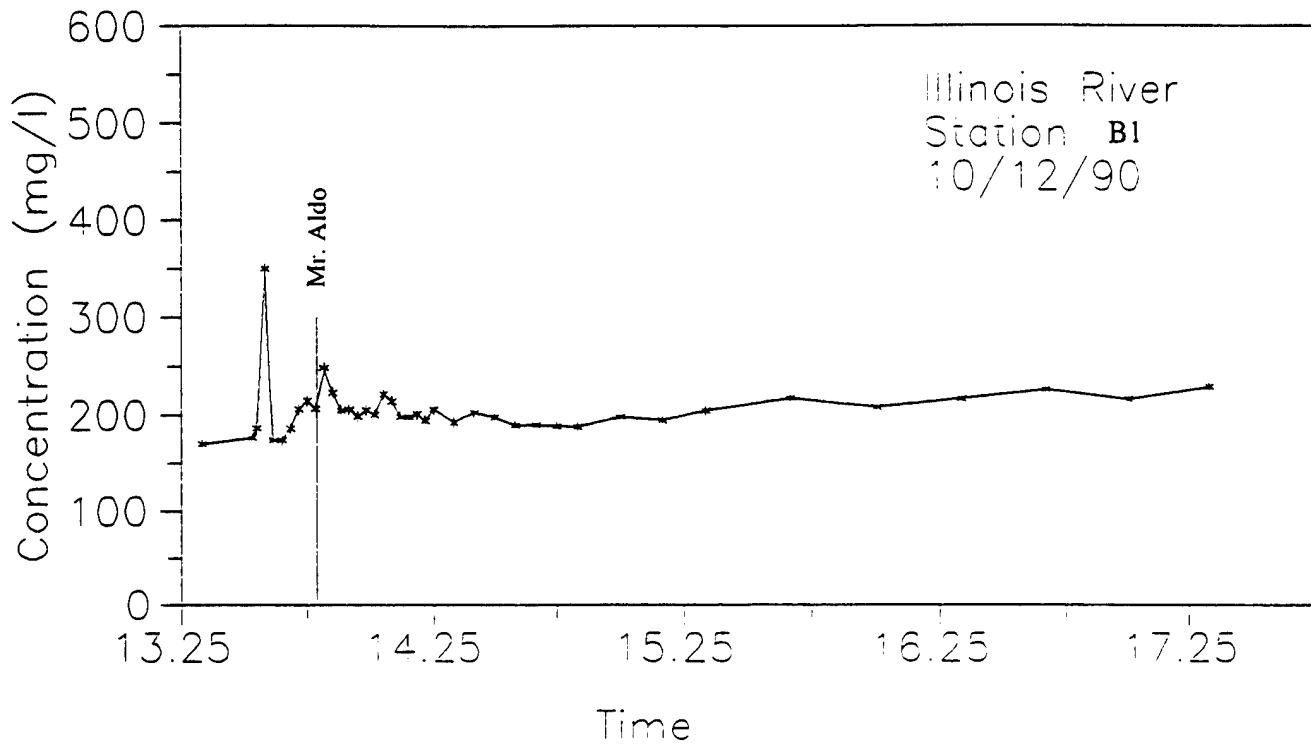
Location of suspended sediment sampling stations on the Illinois River
near the Kampsville site during October 9-18, 1990 (trip 1)



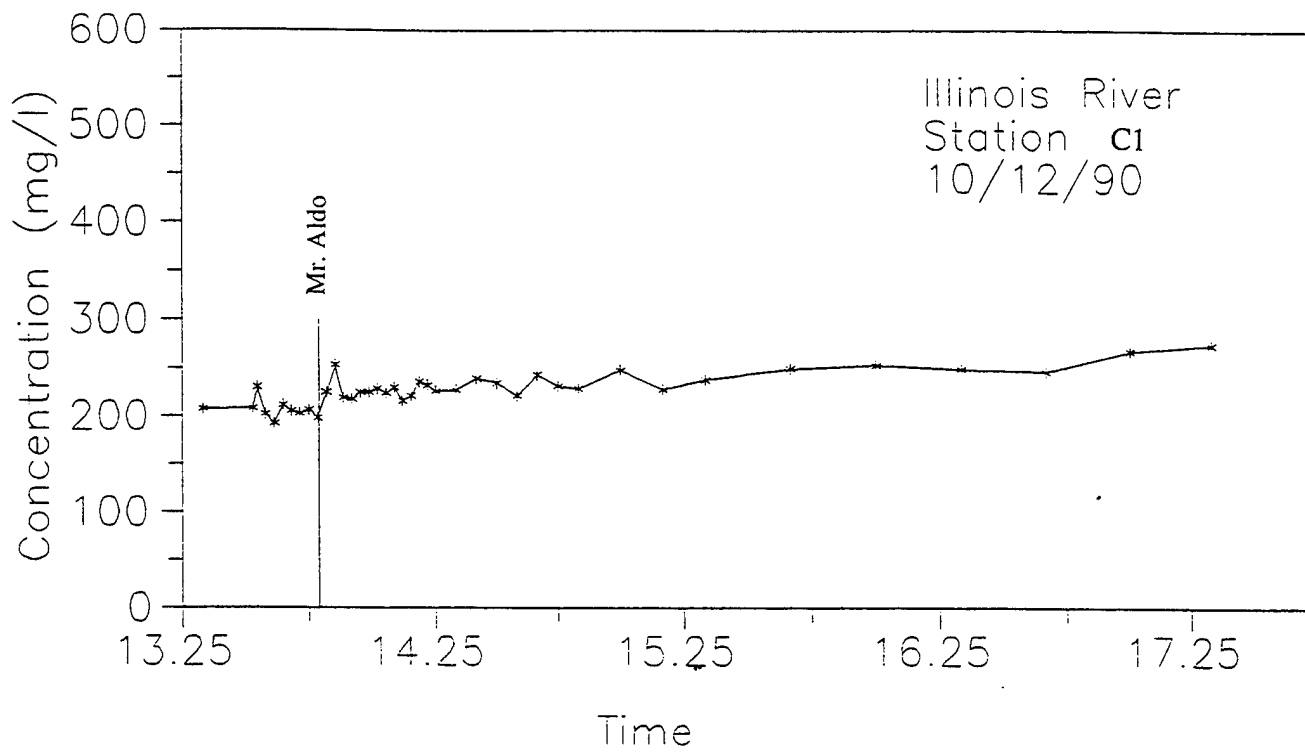
Stations A1 and A2 October 12, 1990



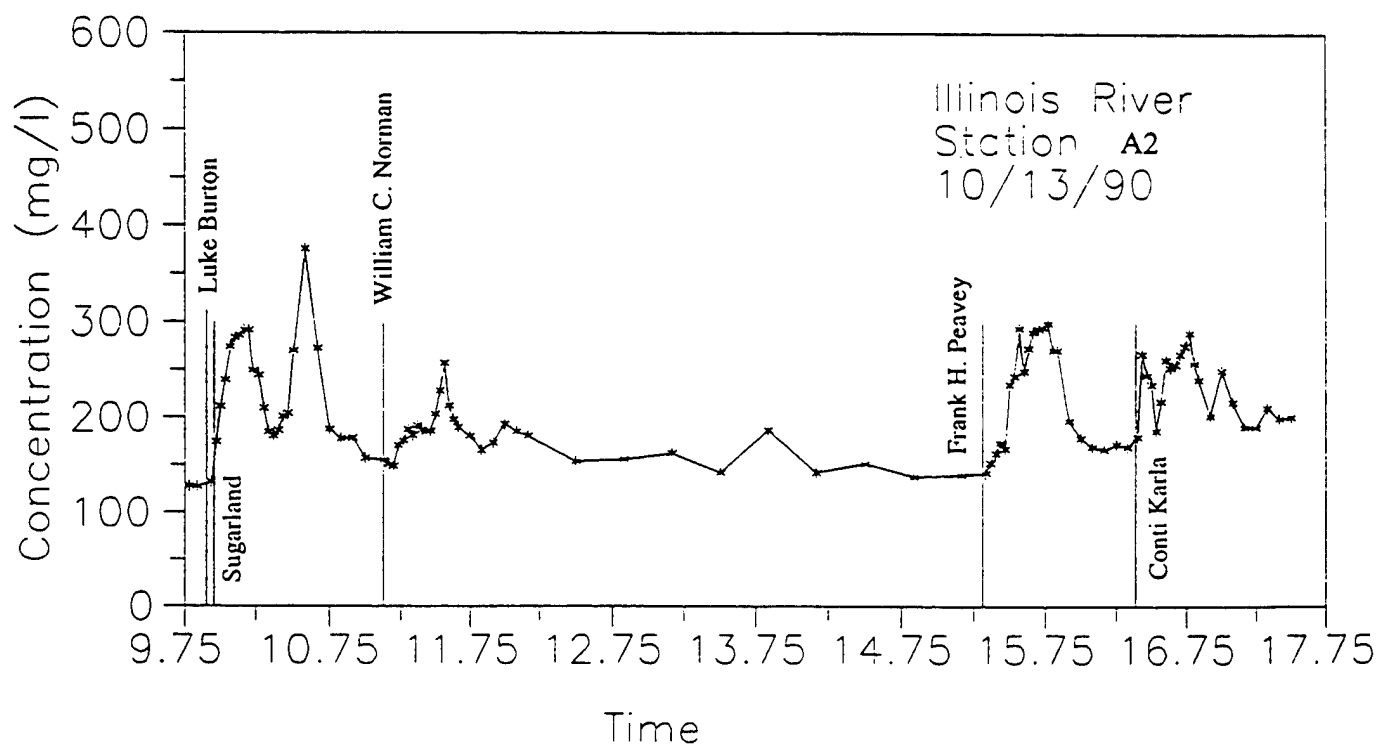
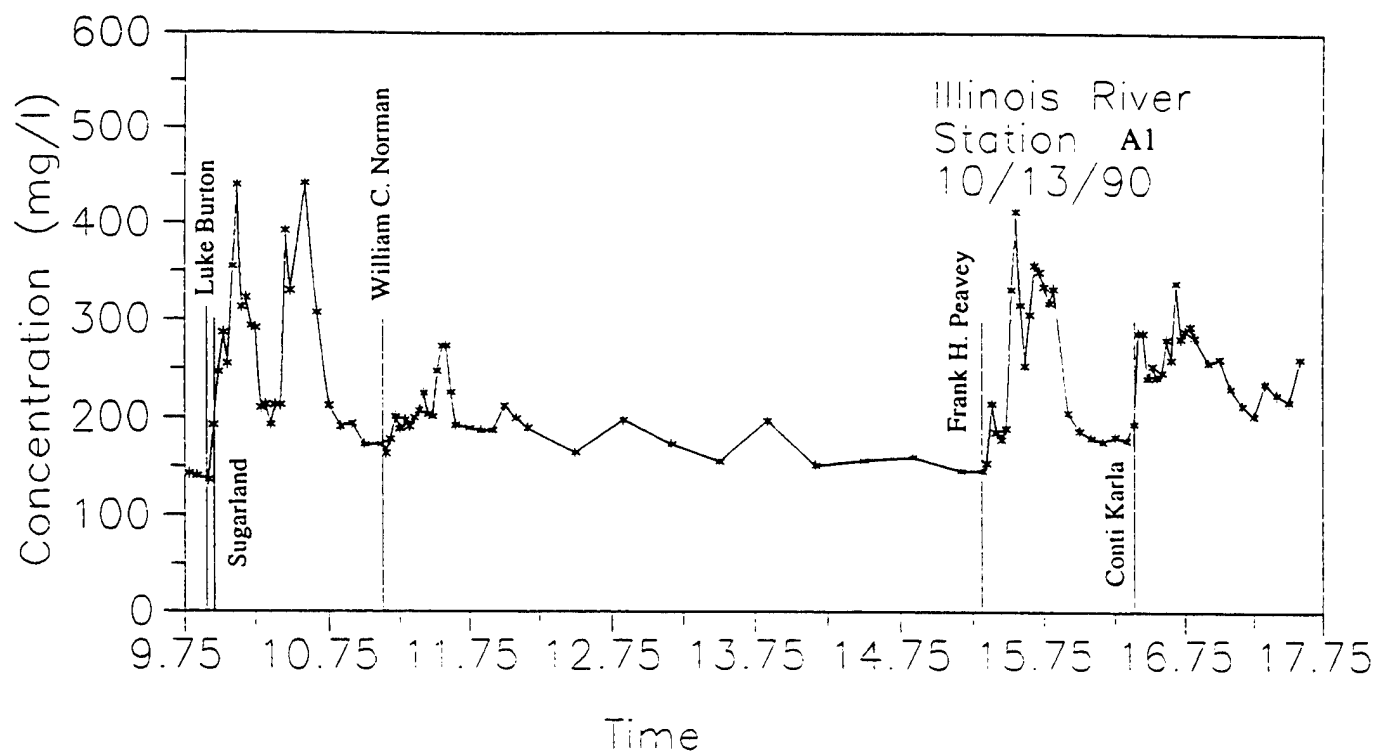
Stations B1 and B2 October 12, 1990



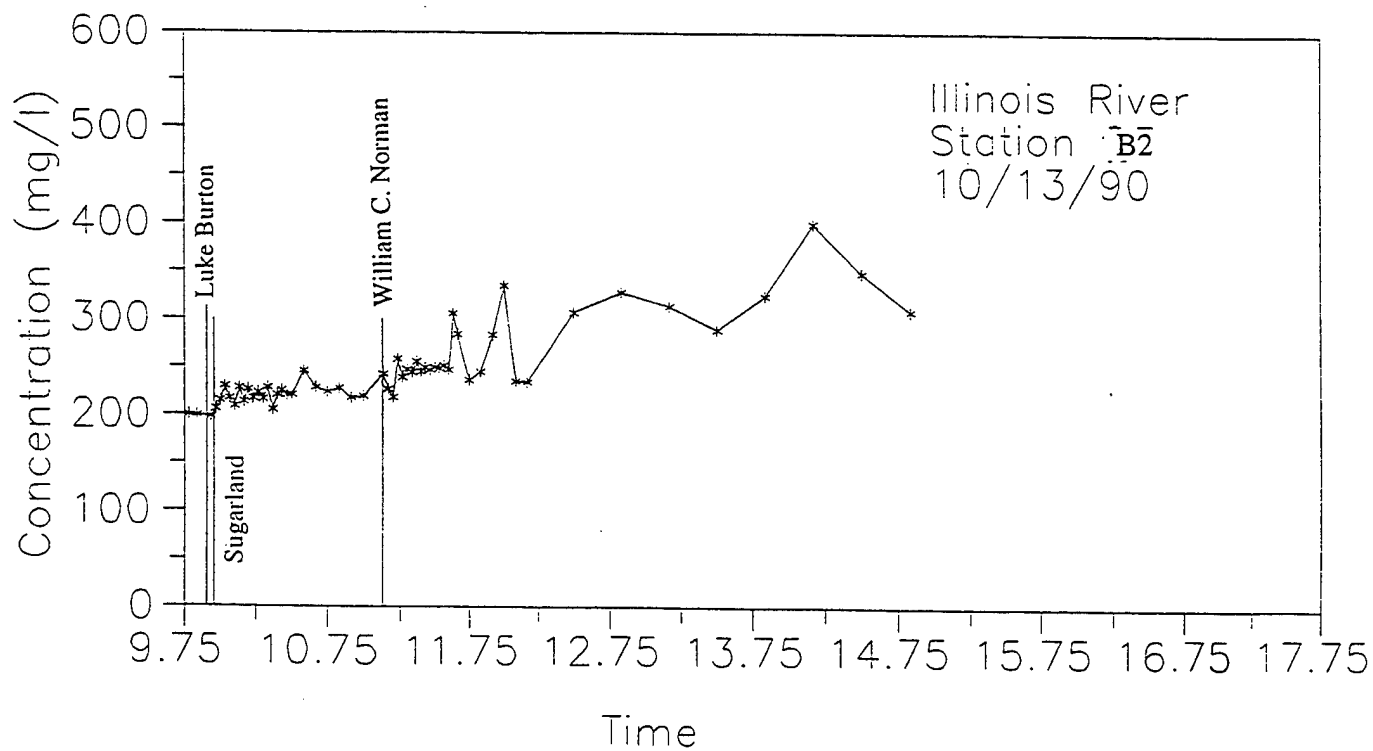
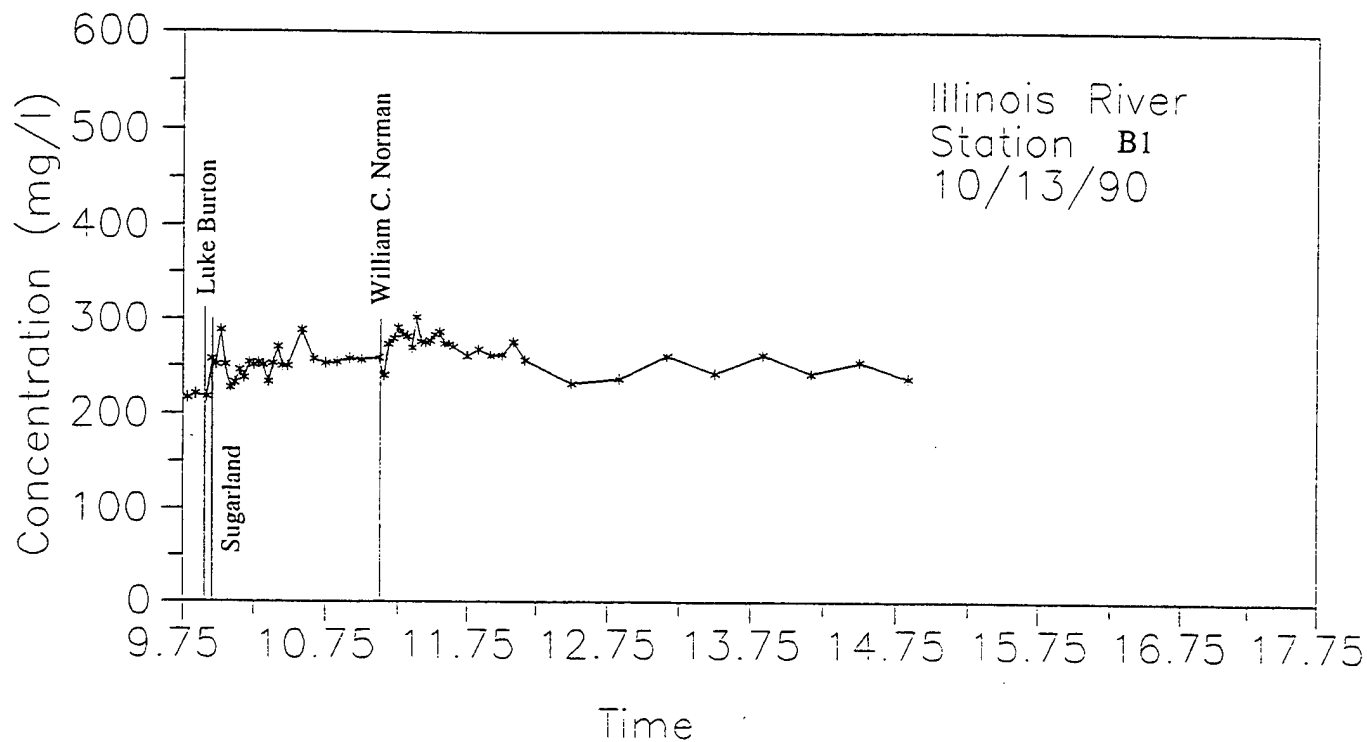
Station C1 October 12, 1990



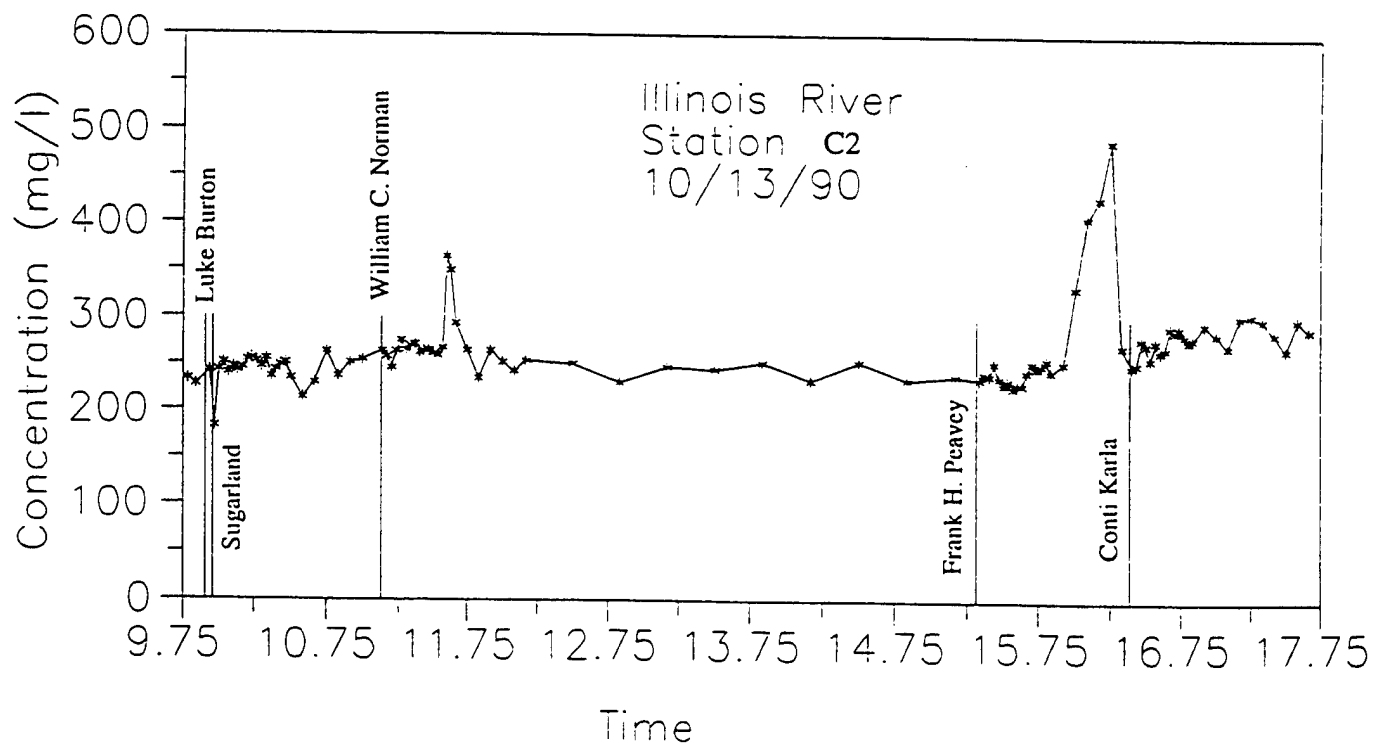
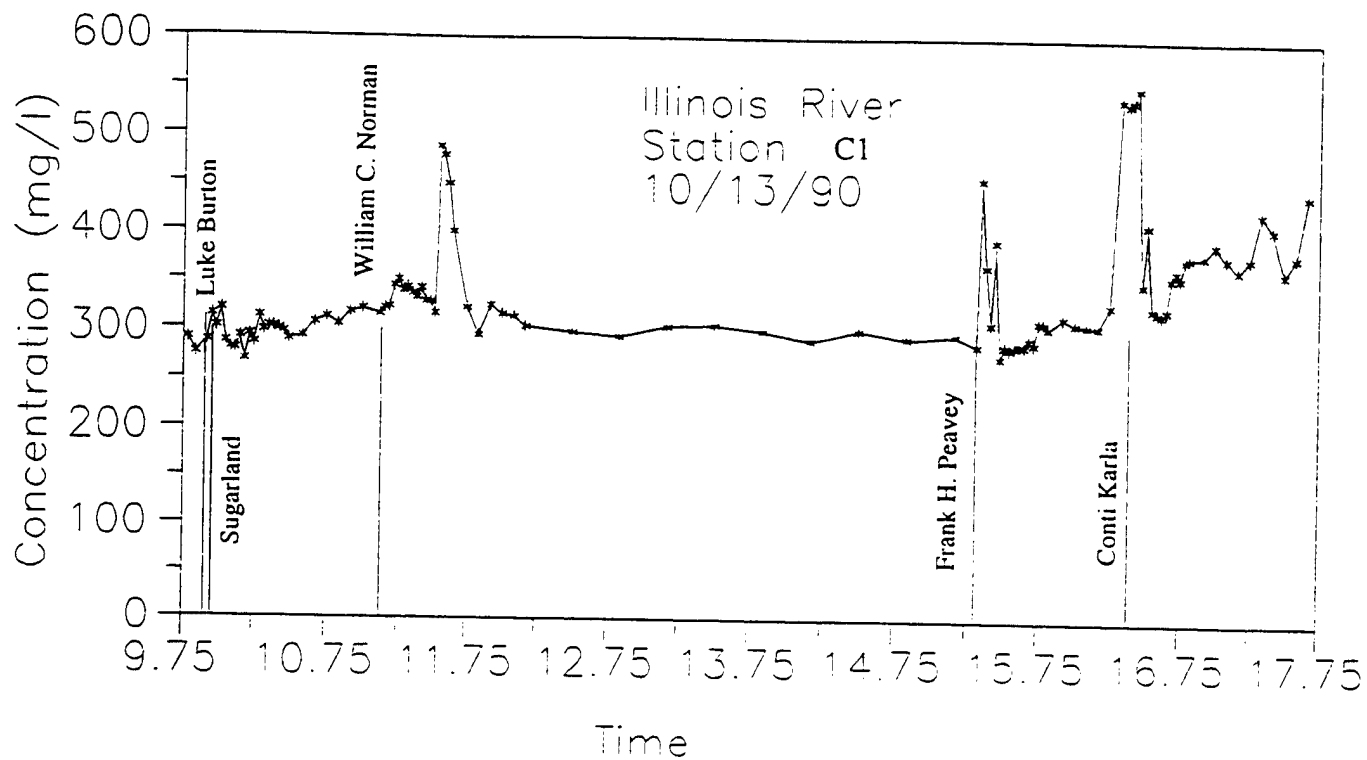
Stations A1 and A2 October 13, 1990



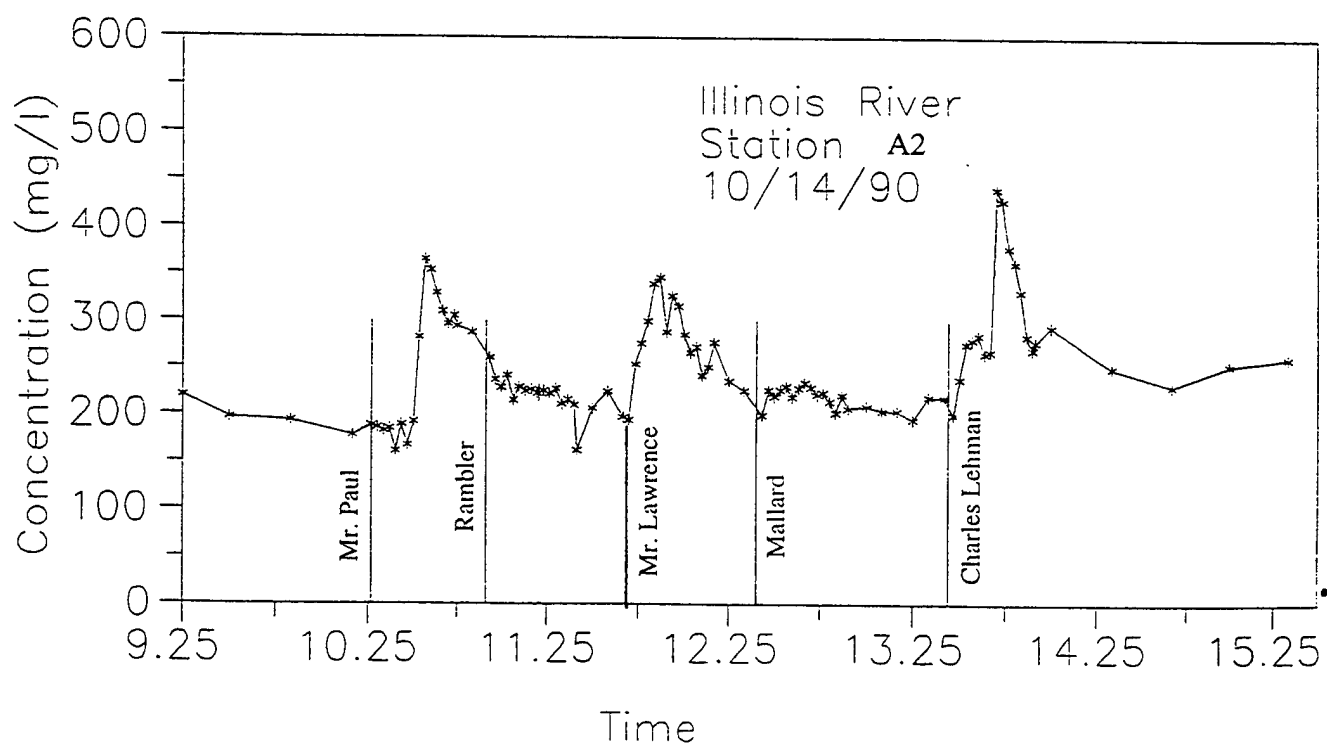
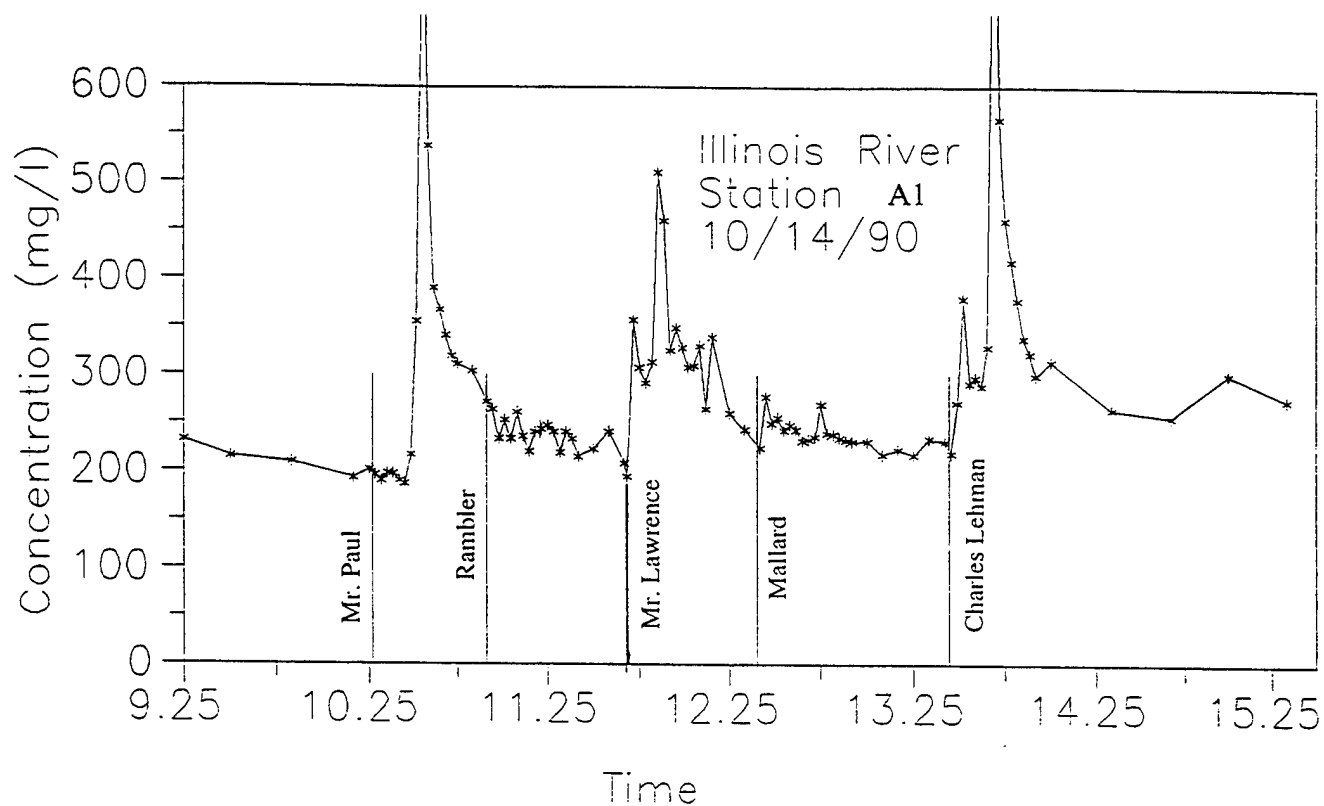
Stations B1 and B2 October 13, 1990



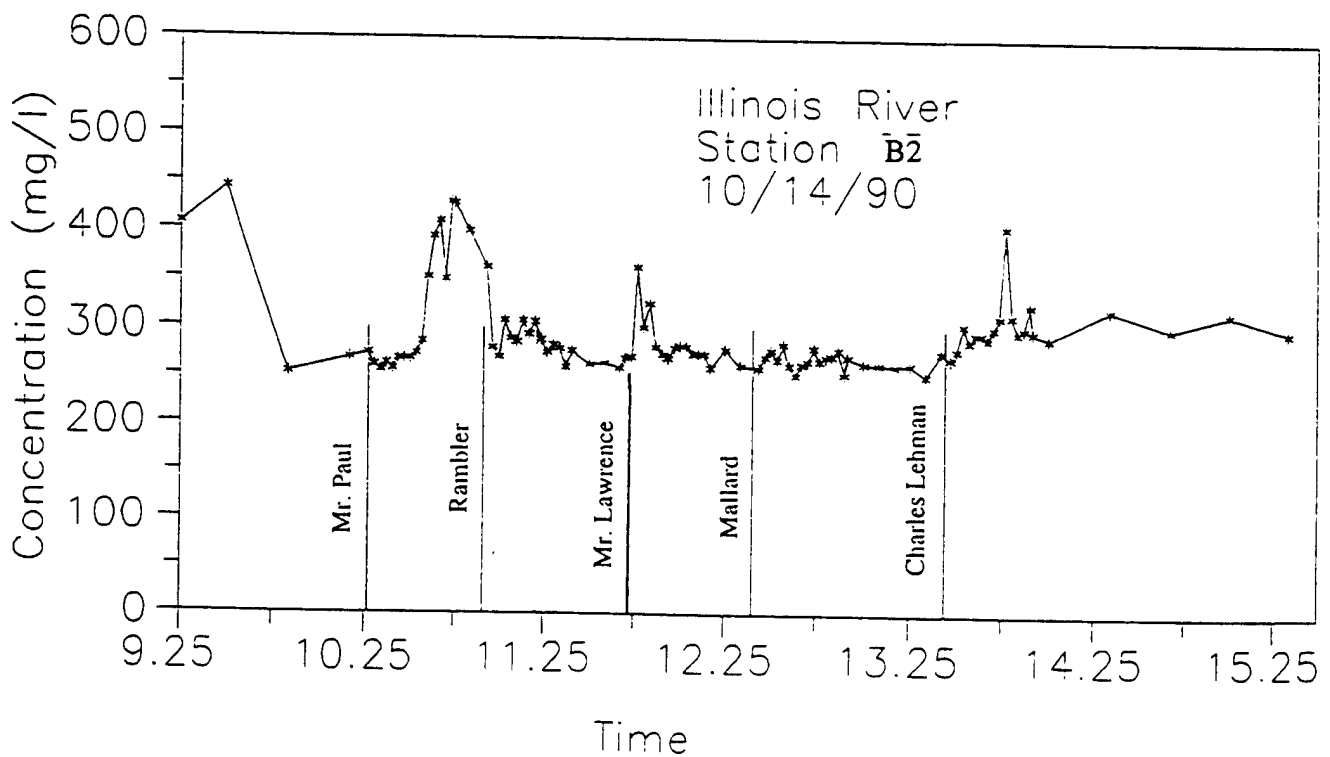
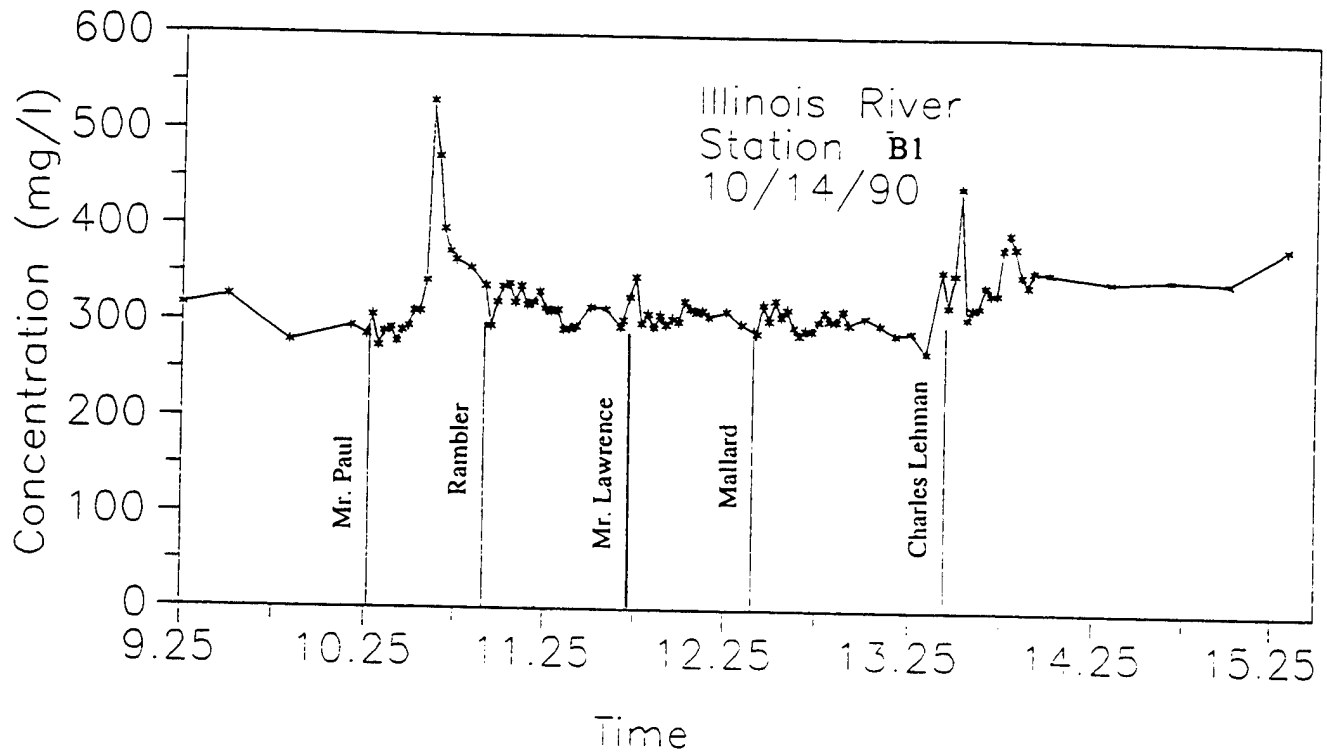
Stations C1 and C2 October 13, 1990



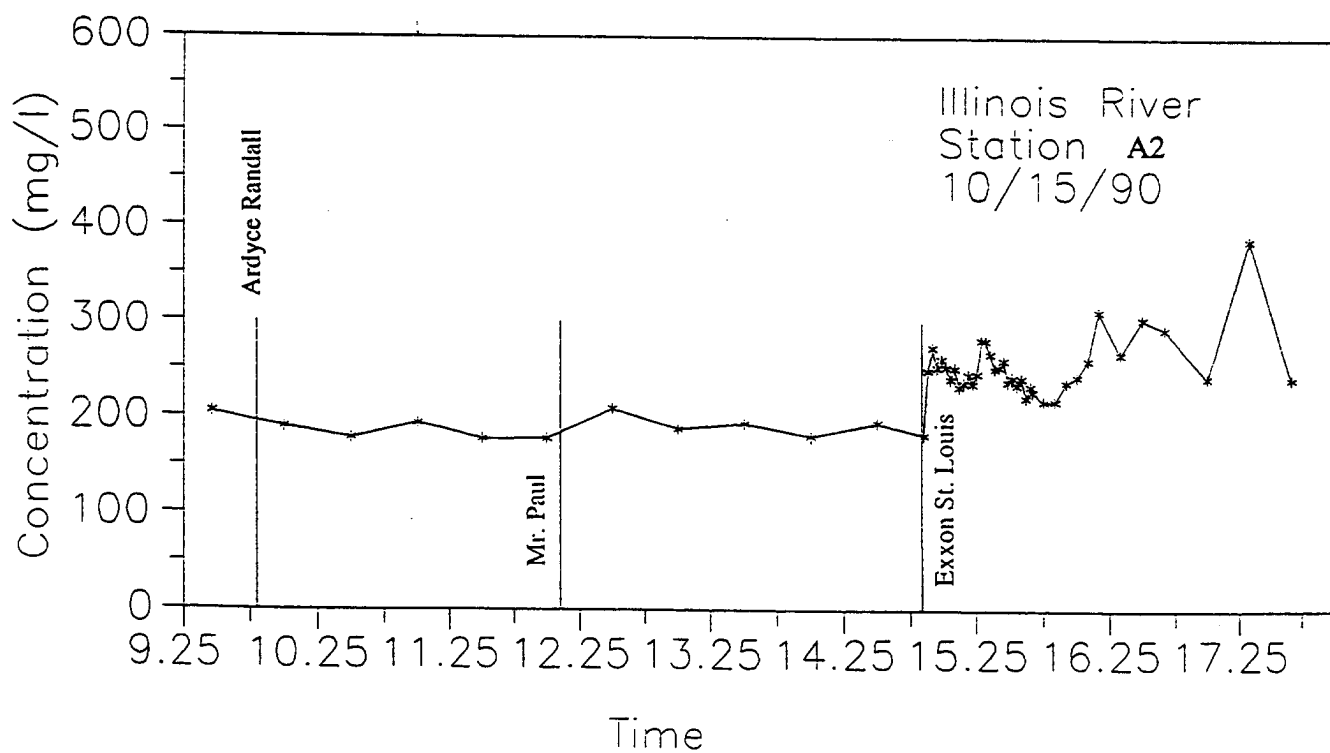
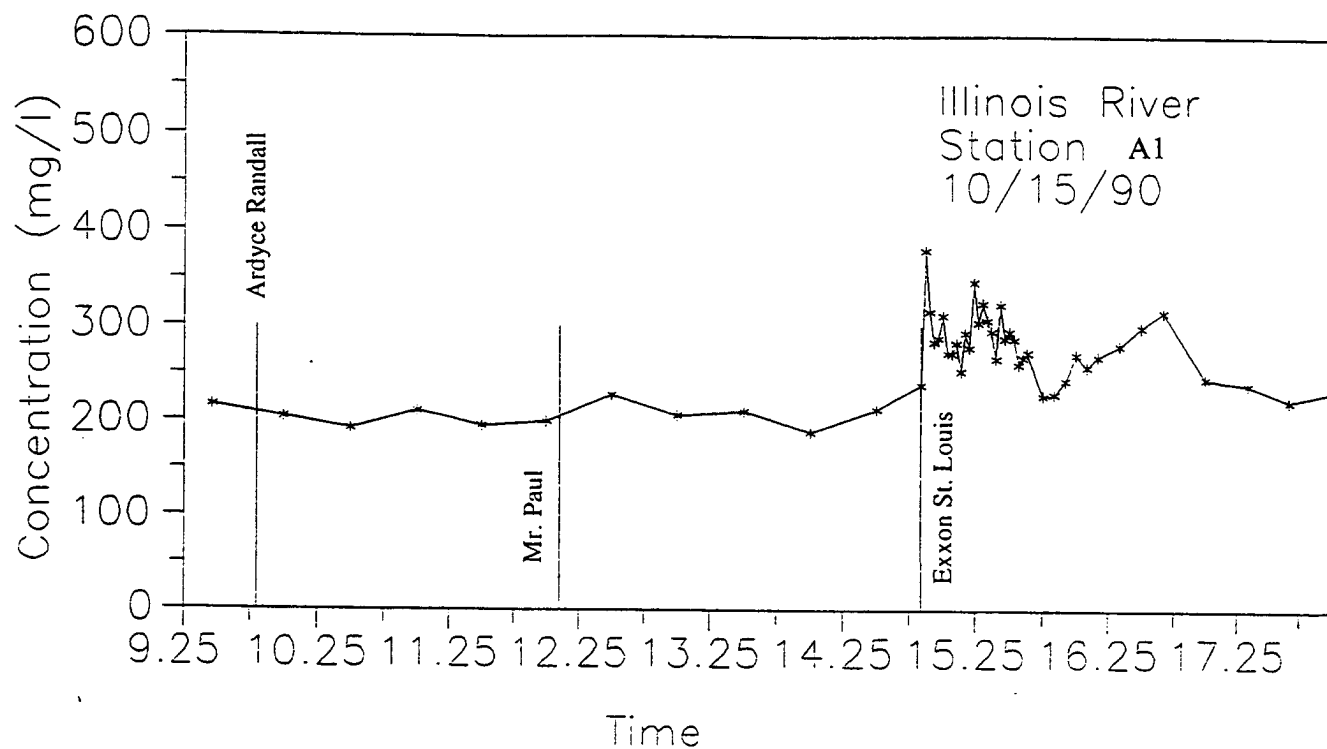
Stations A1 and A2 October 14, 1990



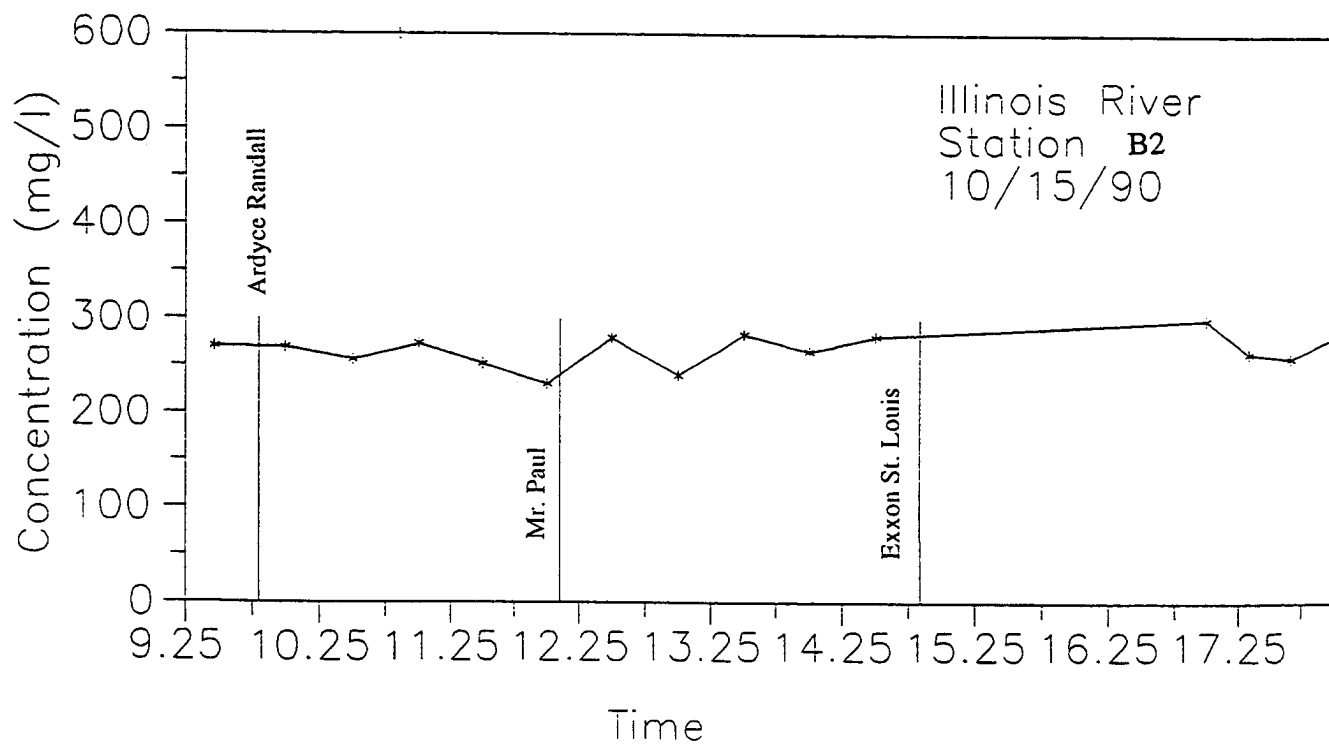
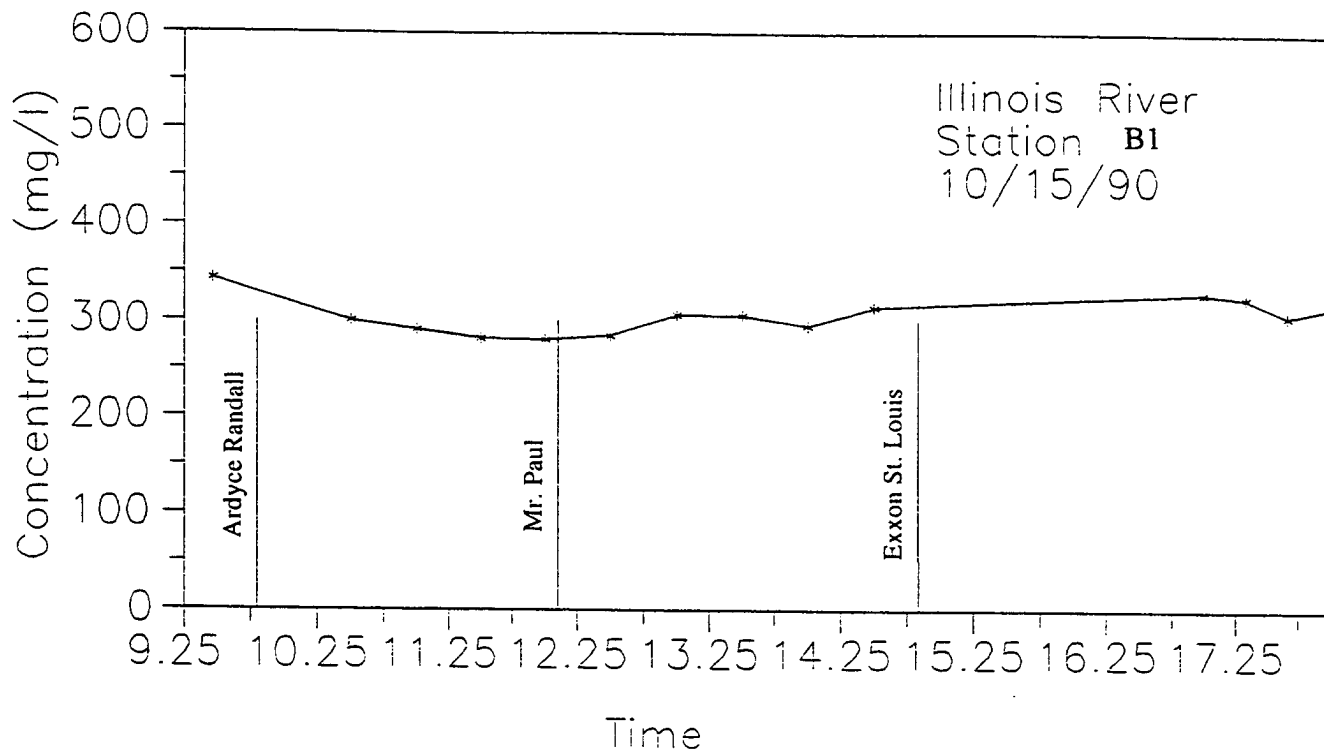
Stations B1 and B2 October 14, 1990



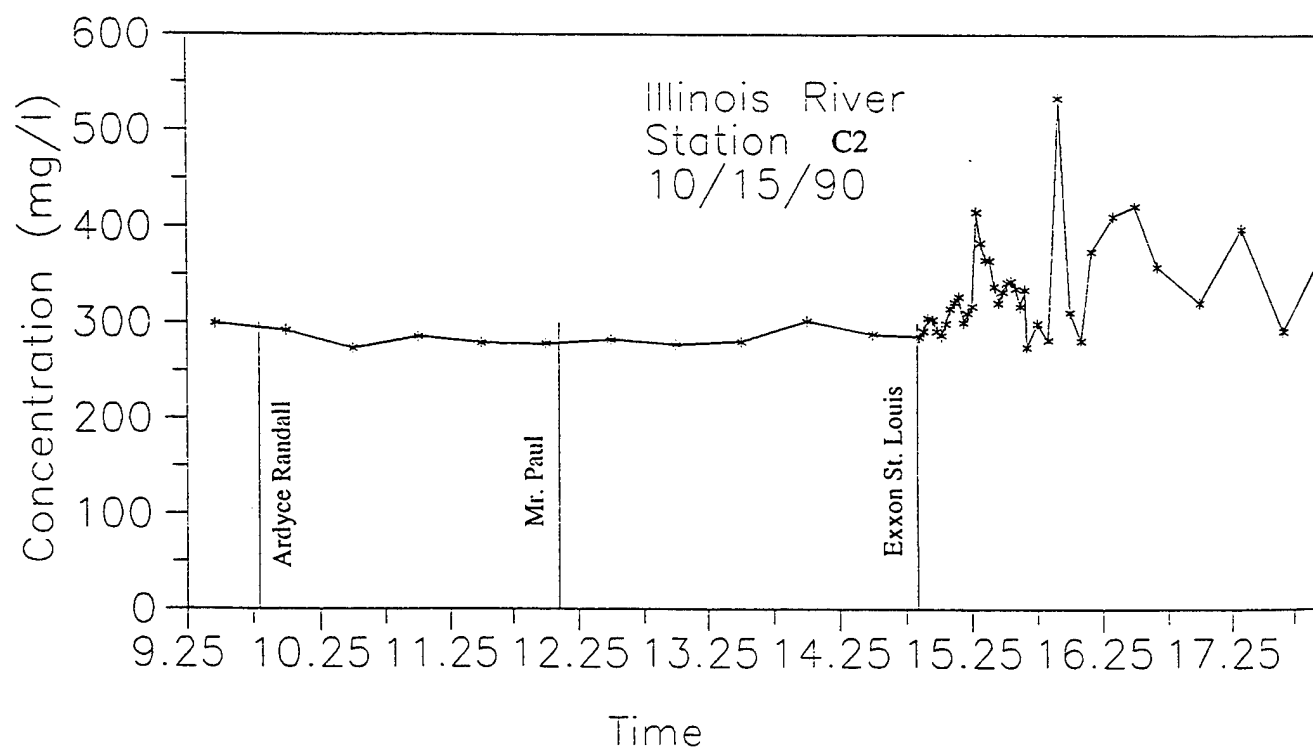
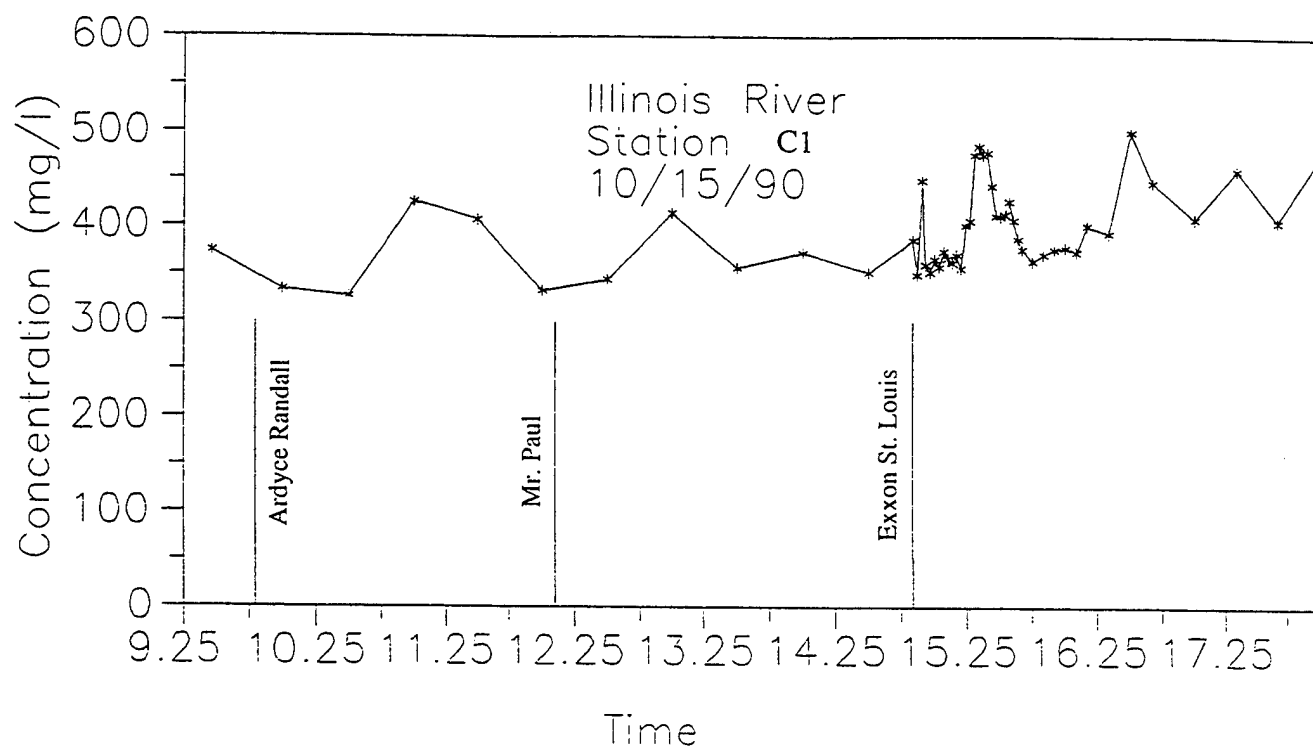
Stations A1 and A2 October 15, 1990



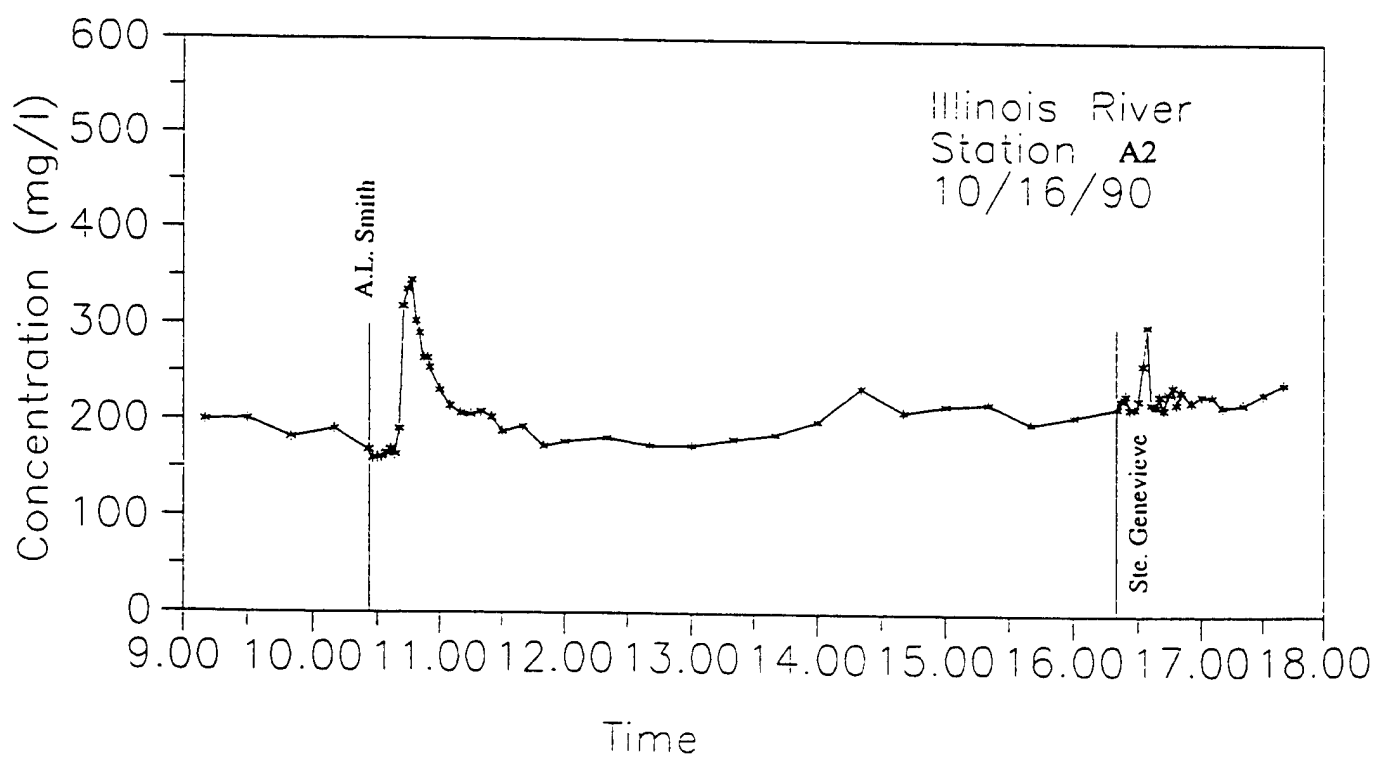
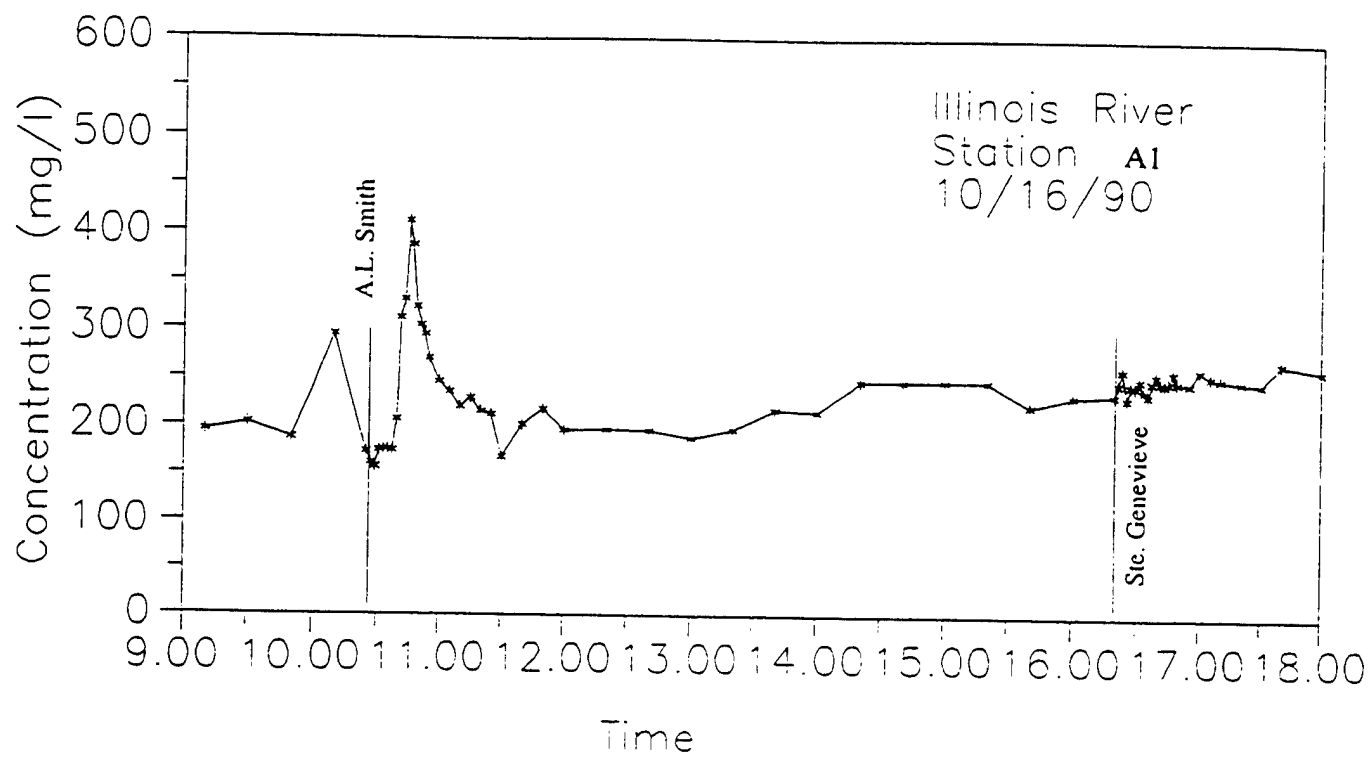
Stations B1 and B2 October 15, 1990



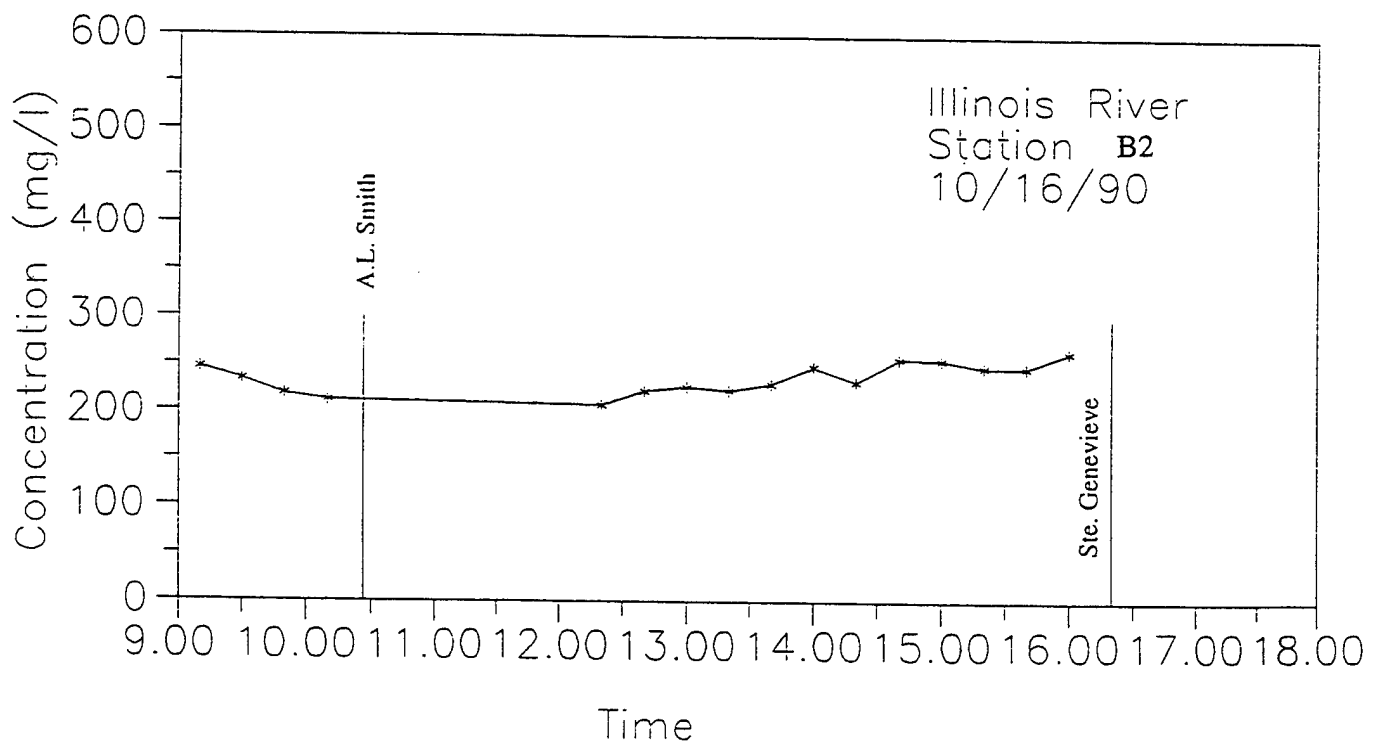
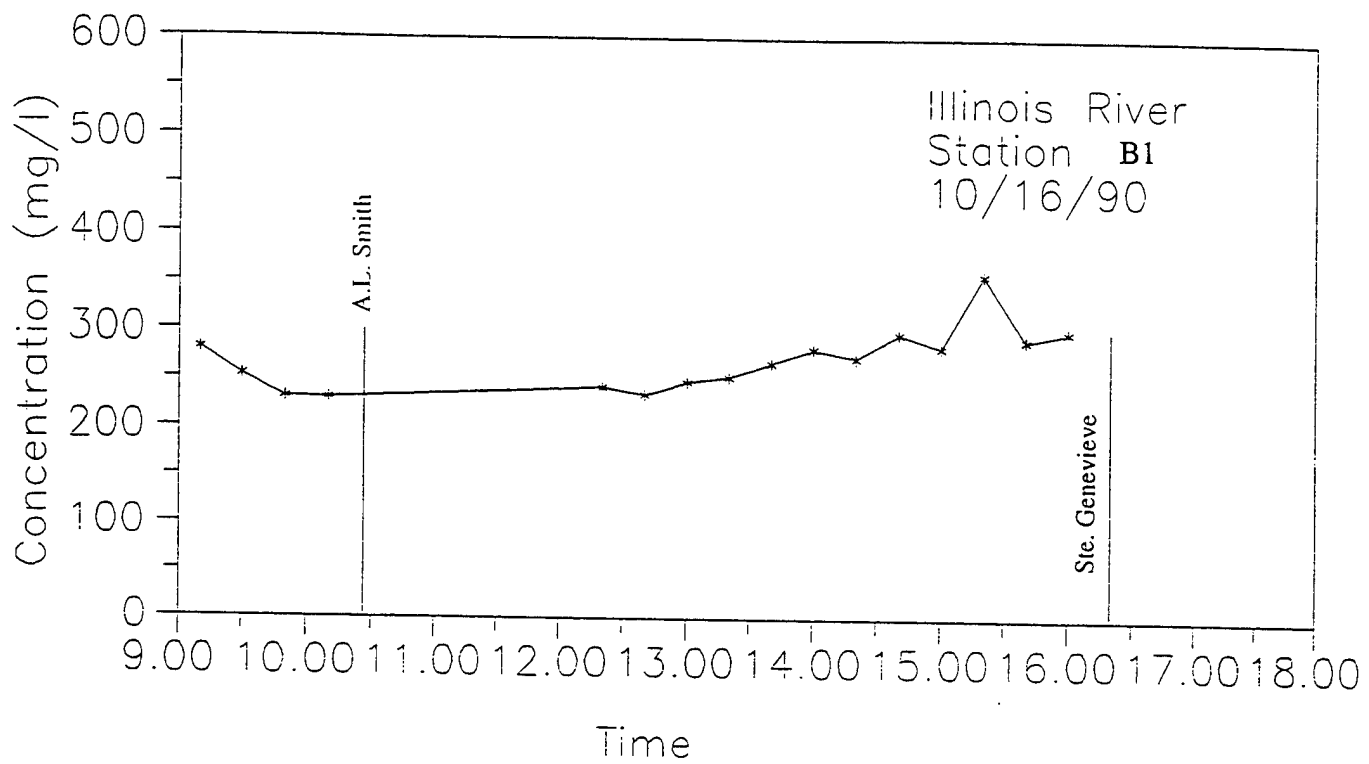
Stations C1 and C2 October 15, 1990



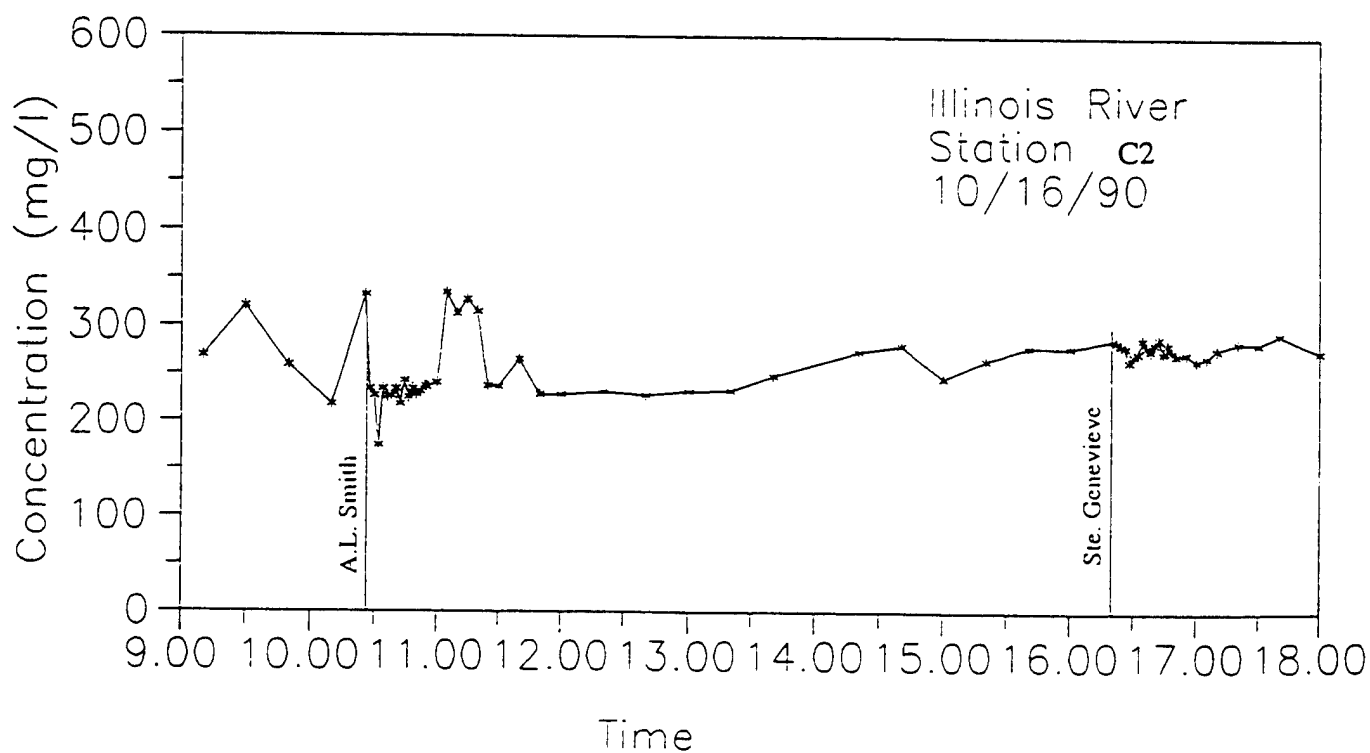
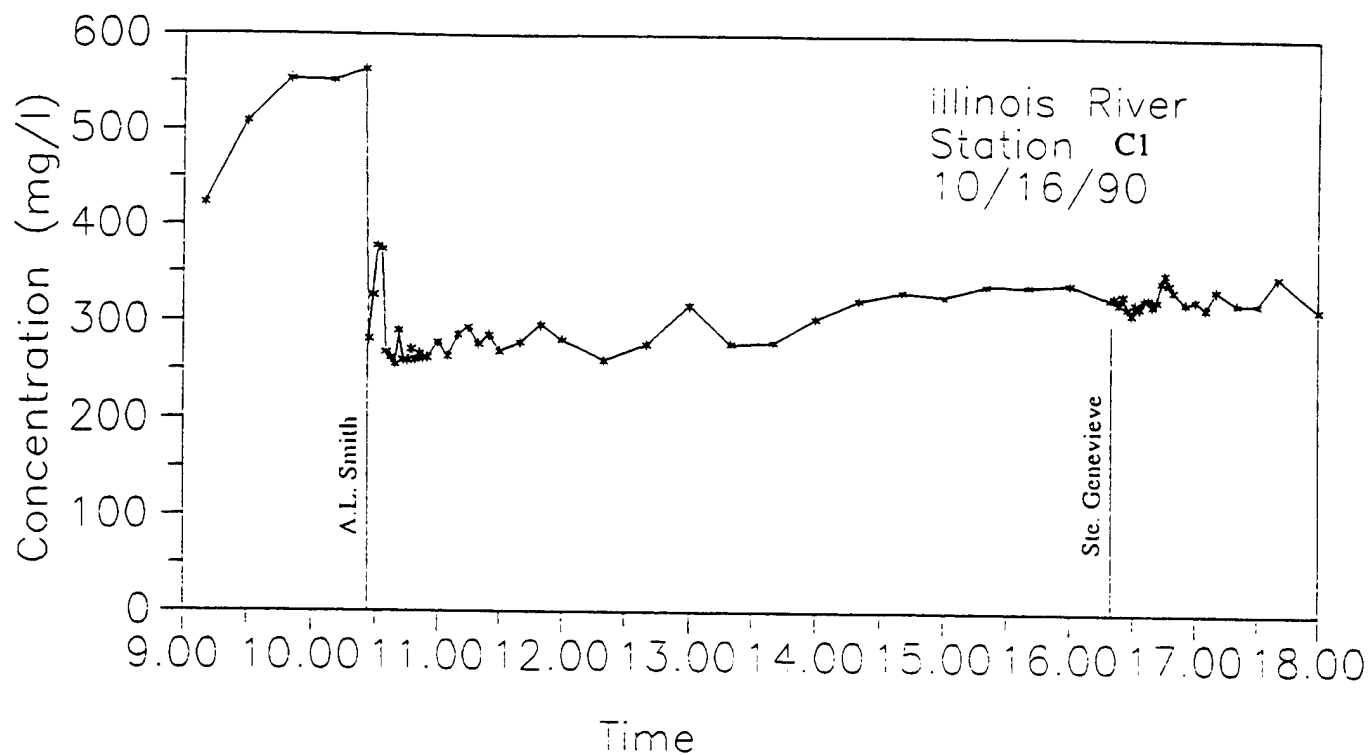
Stations A1 and A2 October 16, 1990



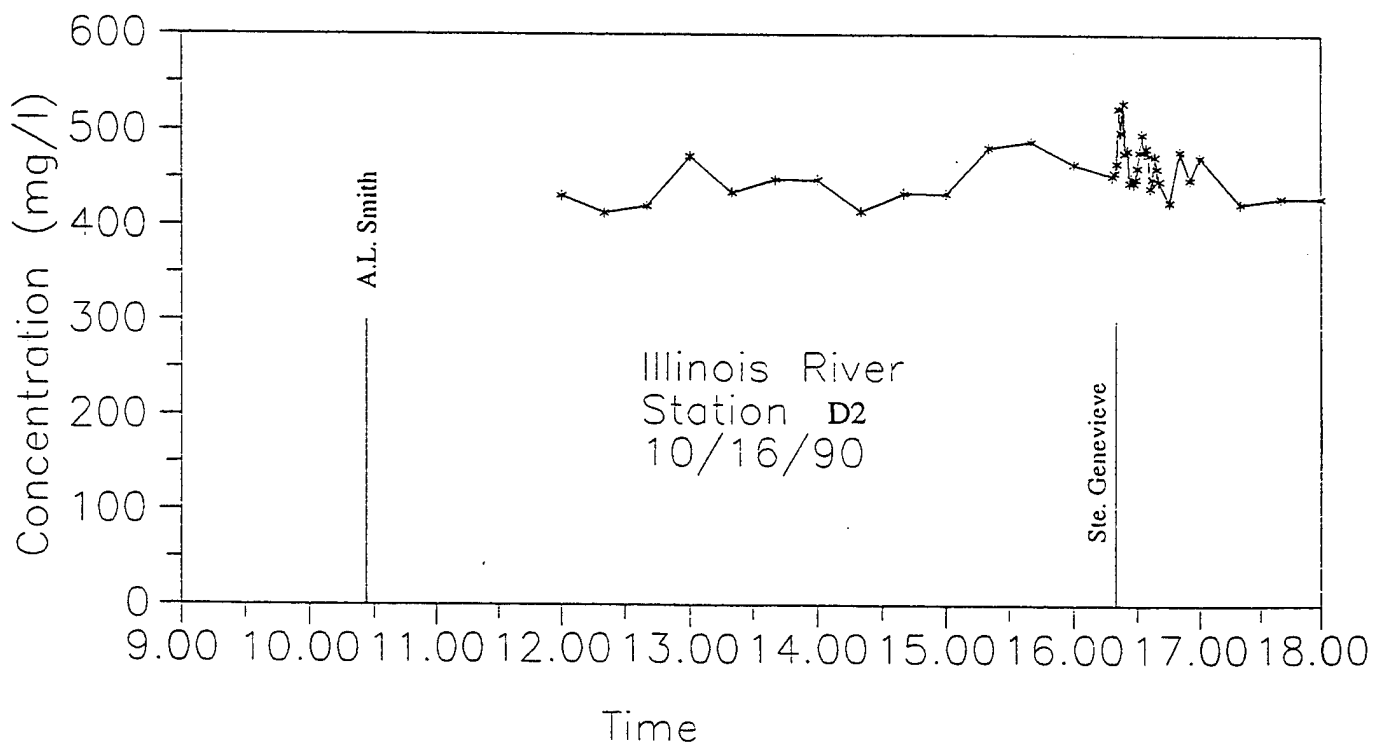
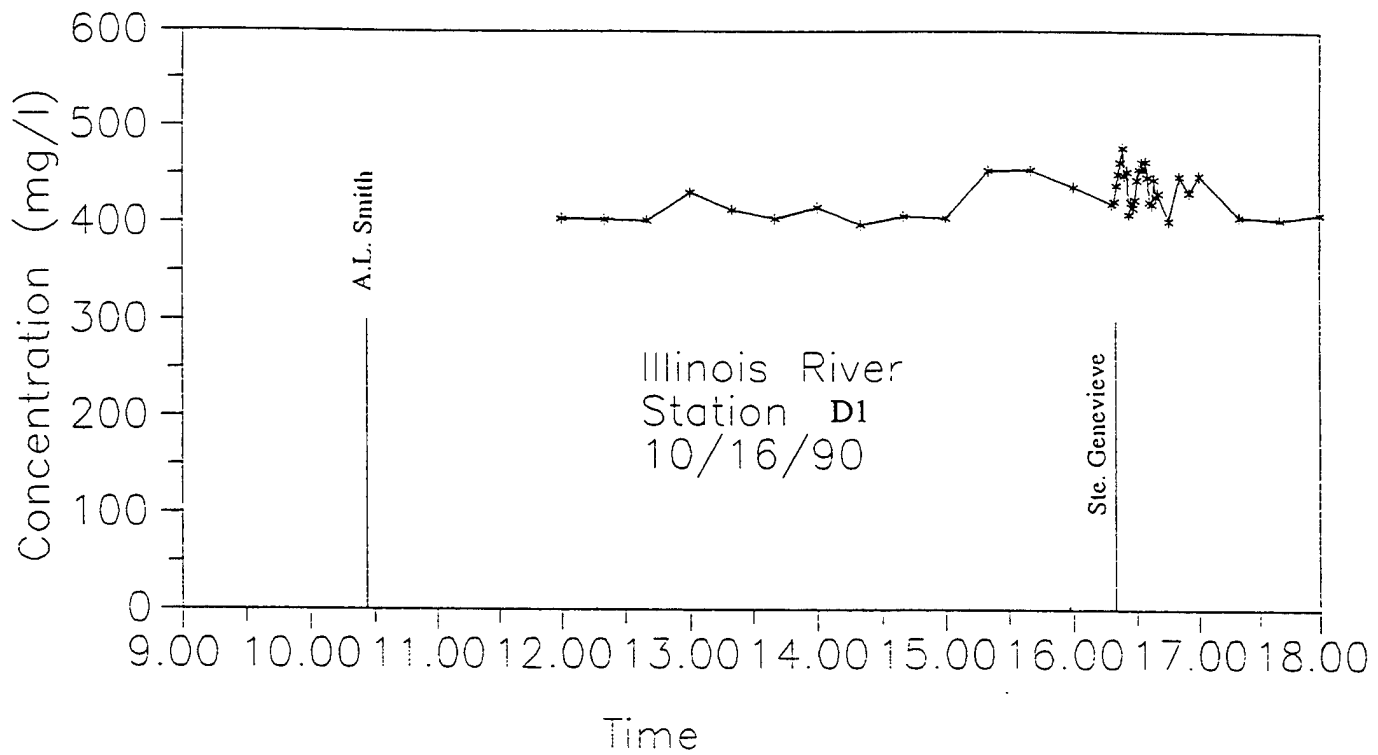
Stations B1 and B2 October 16, 1990



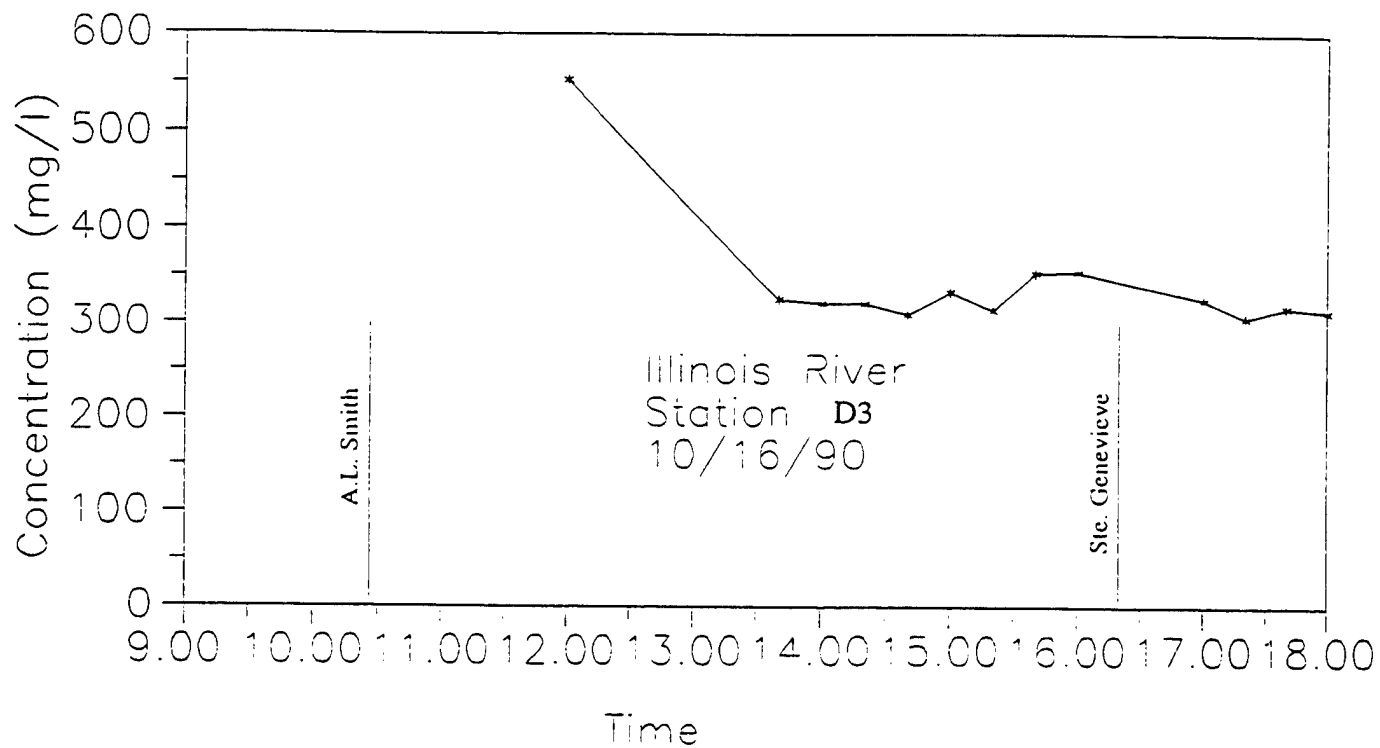
Stations C1 and C2 October 16, 1990



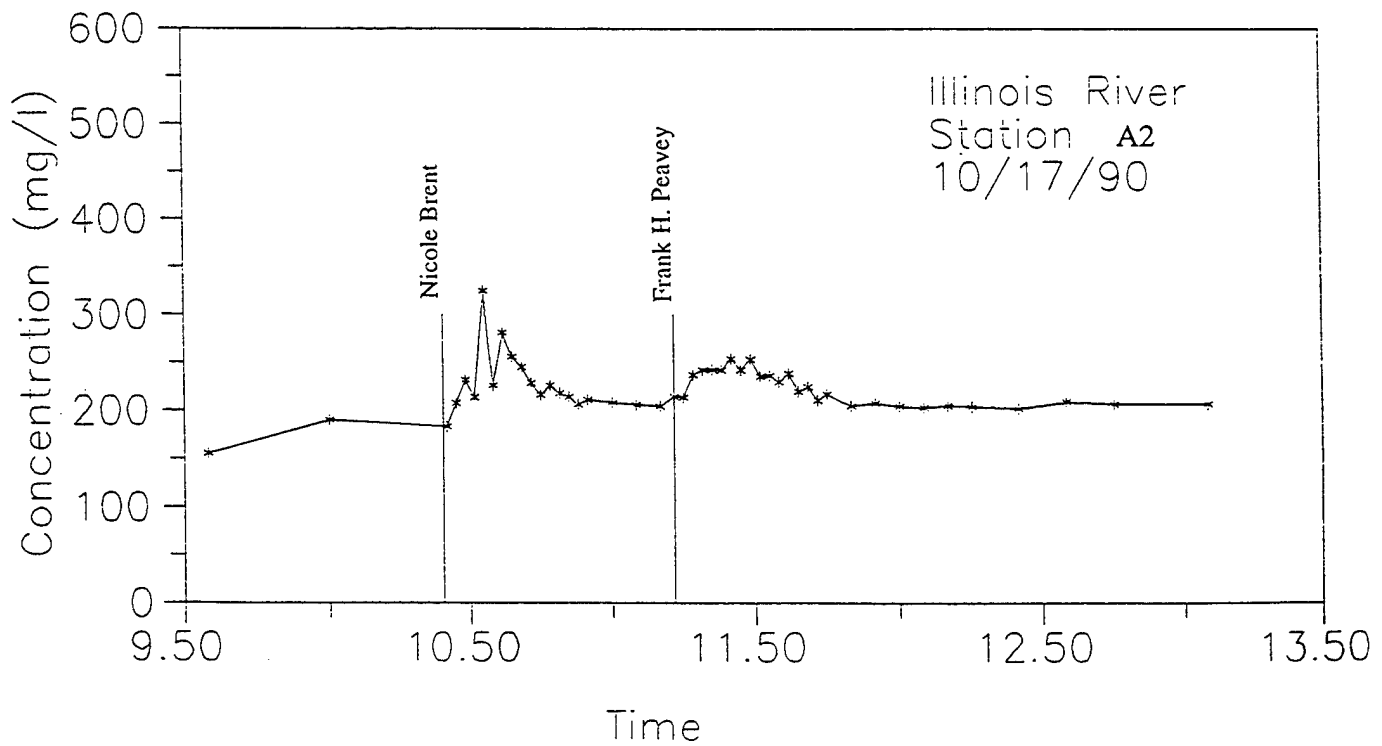
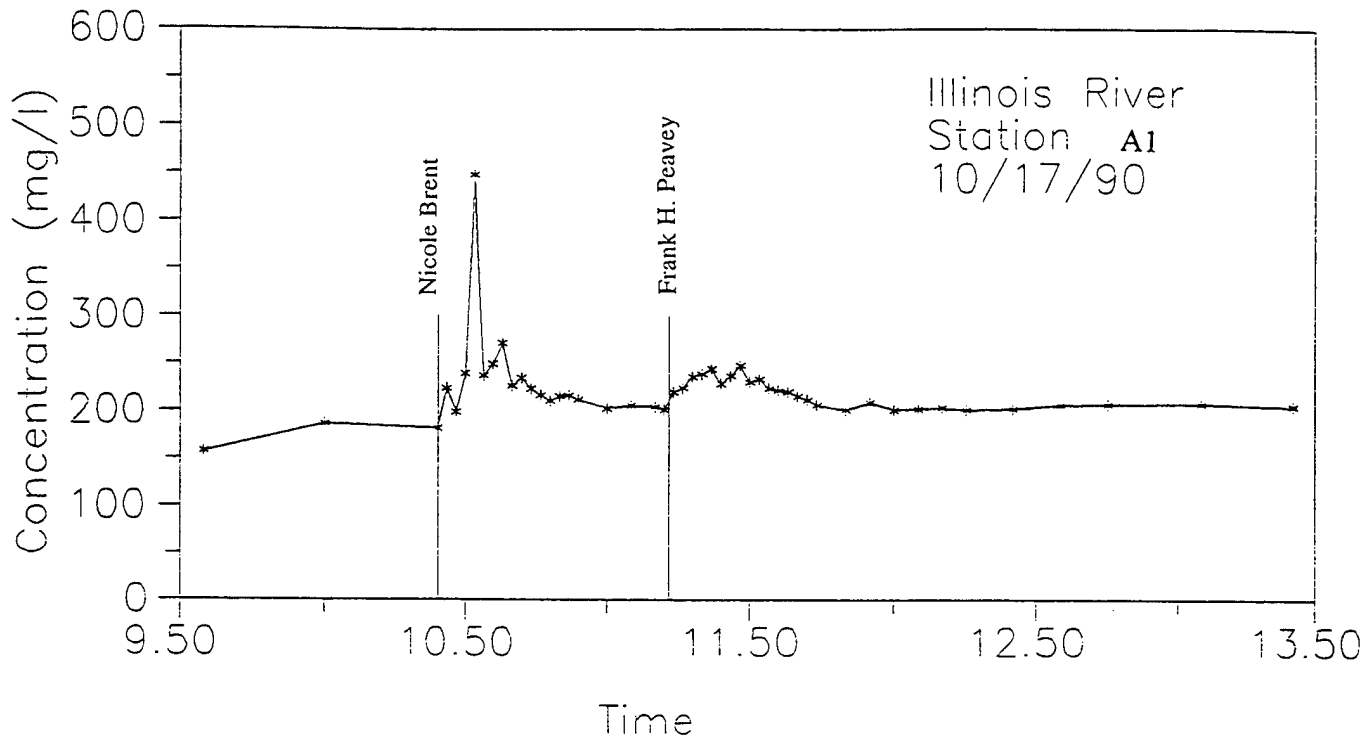
Stations D1 and D2 October 16, 1990



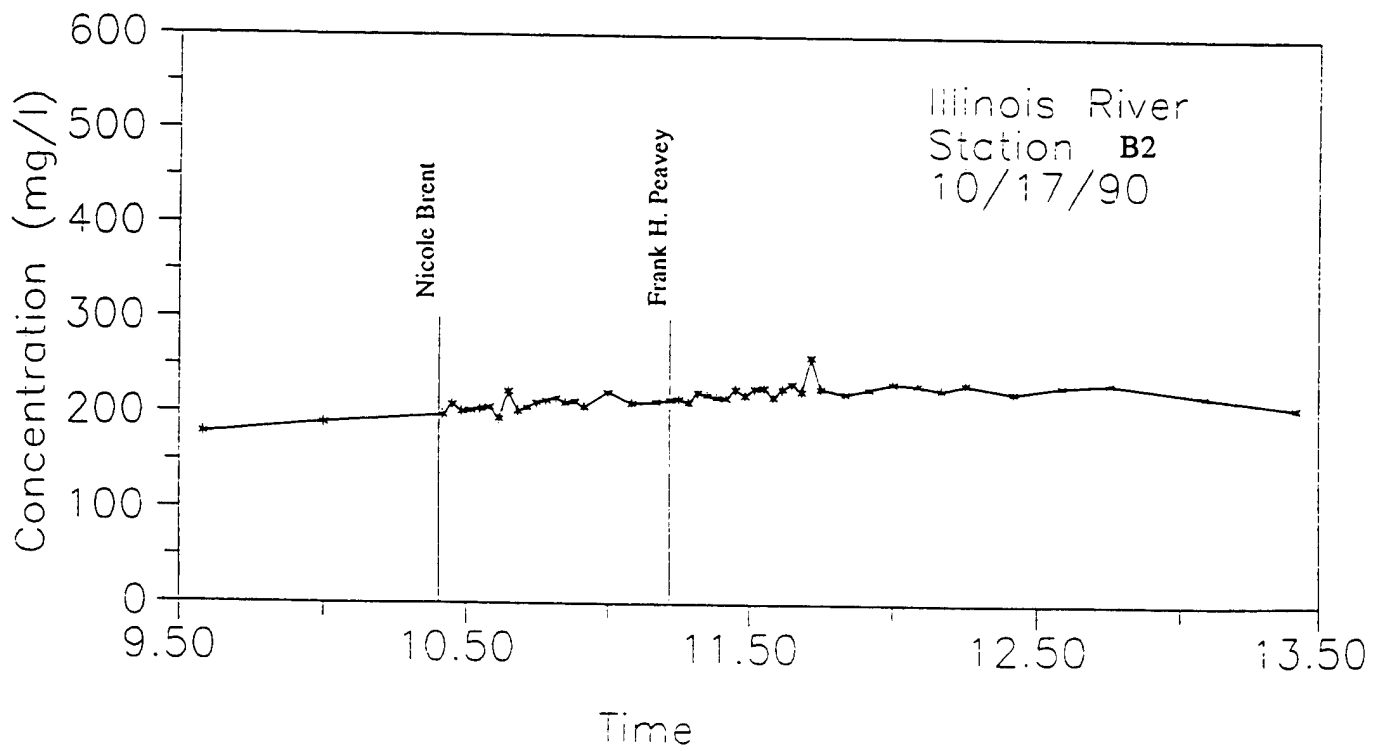
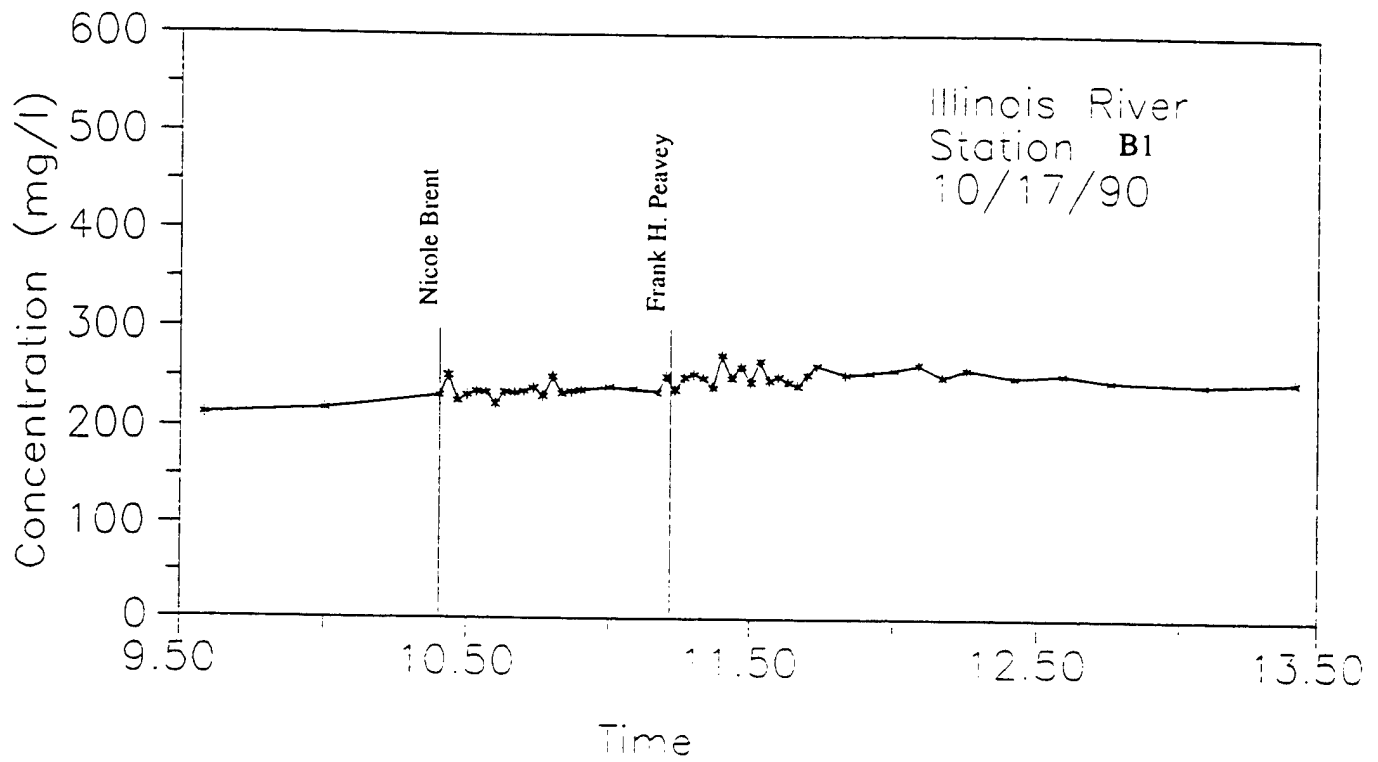
Station D3 October 16, 1990



Stations A1 and A2 October 17, 1990

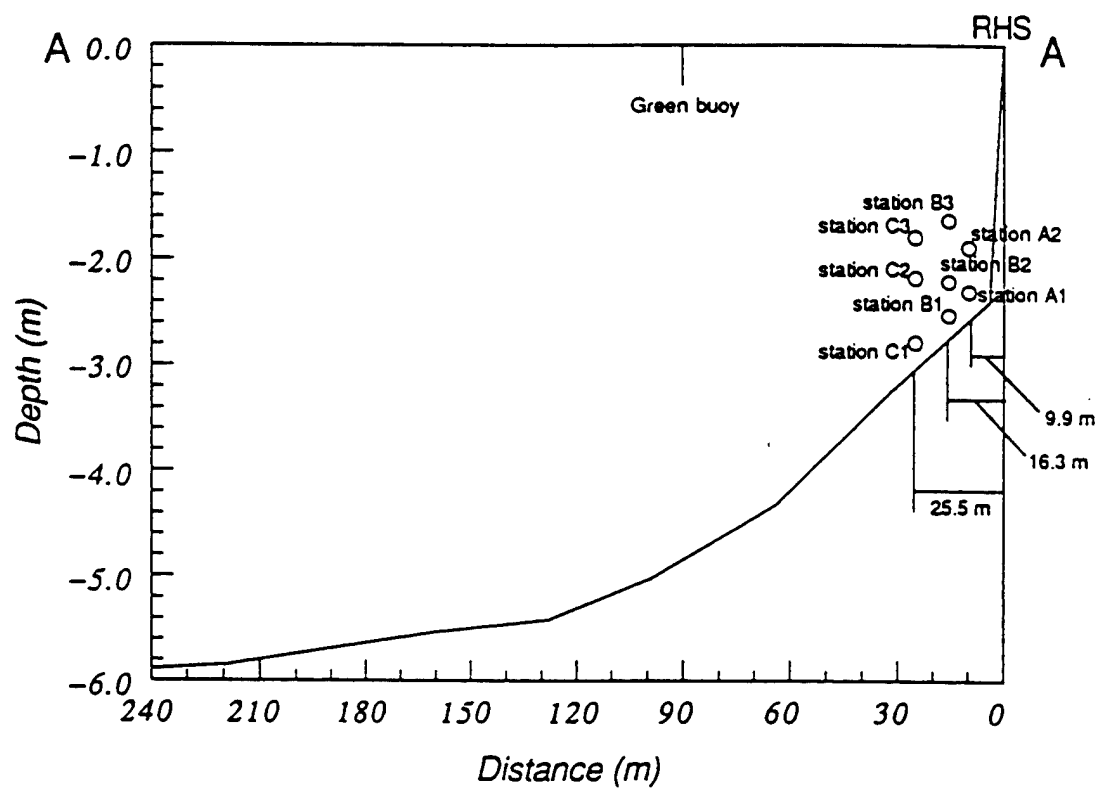


Stations B1 and B2 October 17, 1990

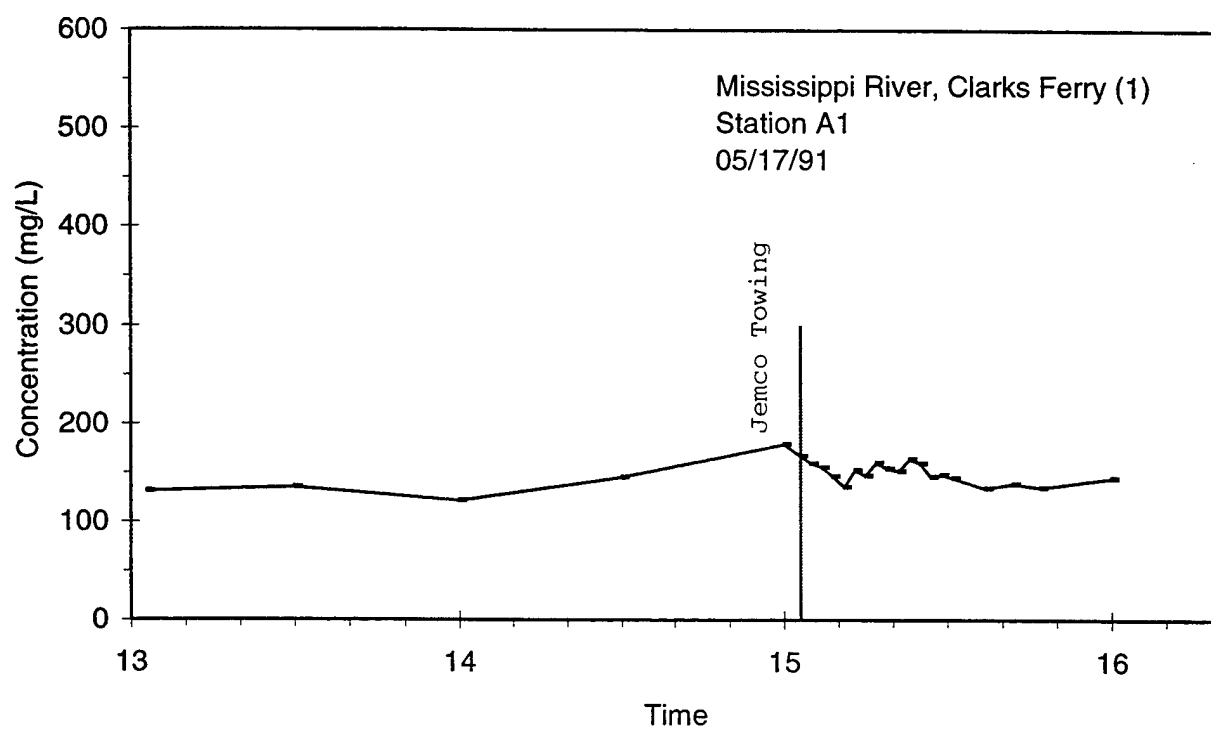


XXV-5. Variation of suspended sediment concentration with time, Clarks Ferry, trip 1

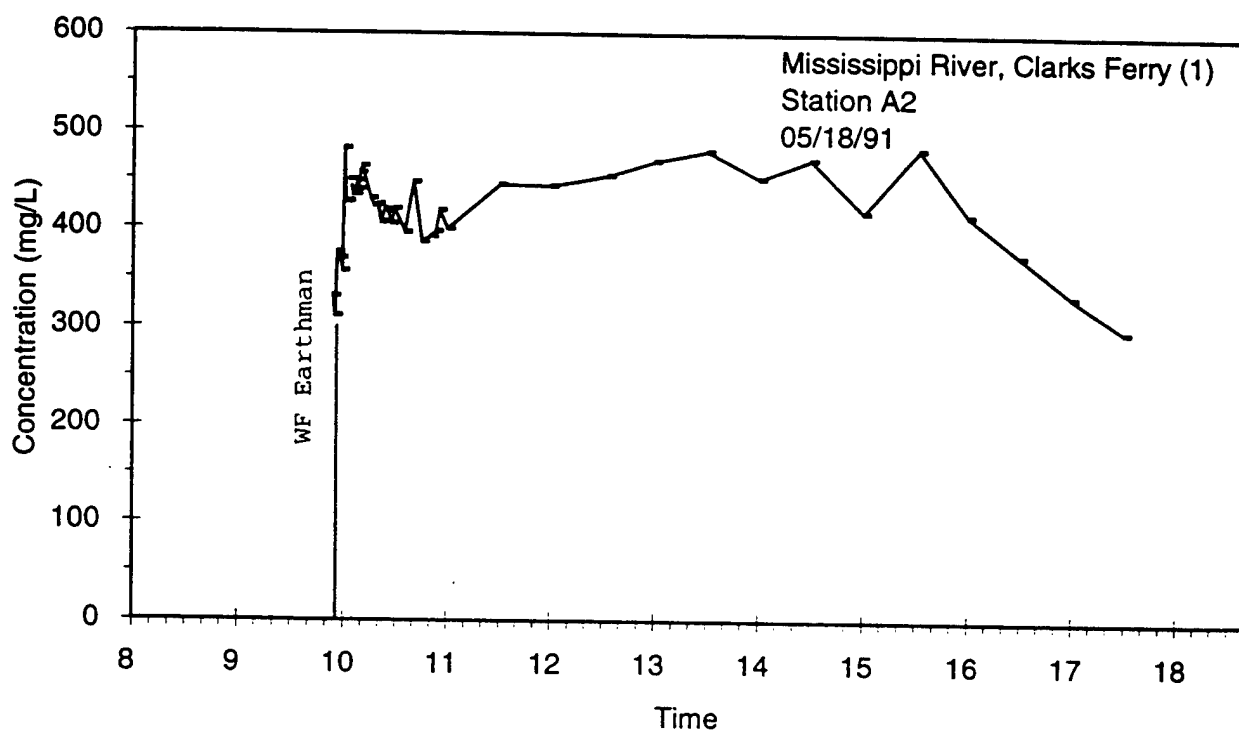
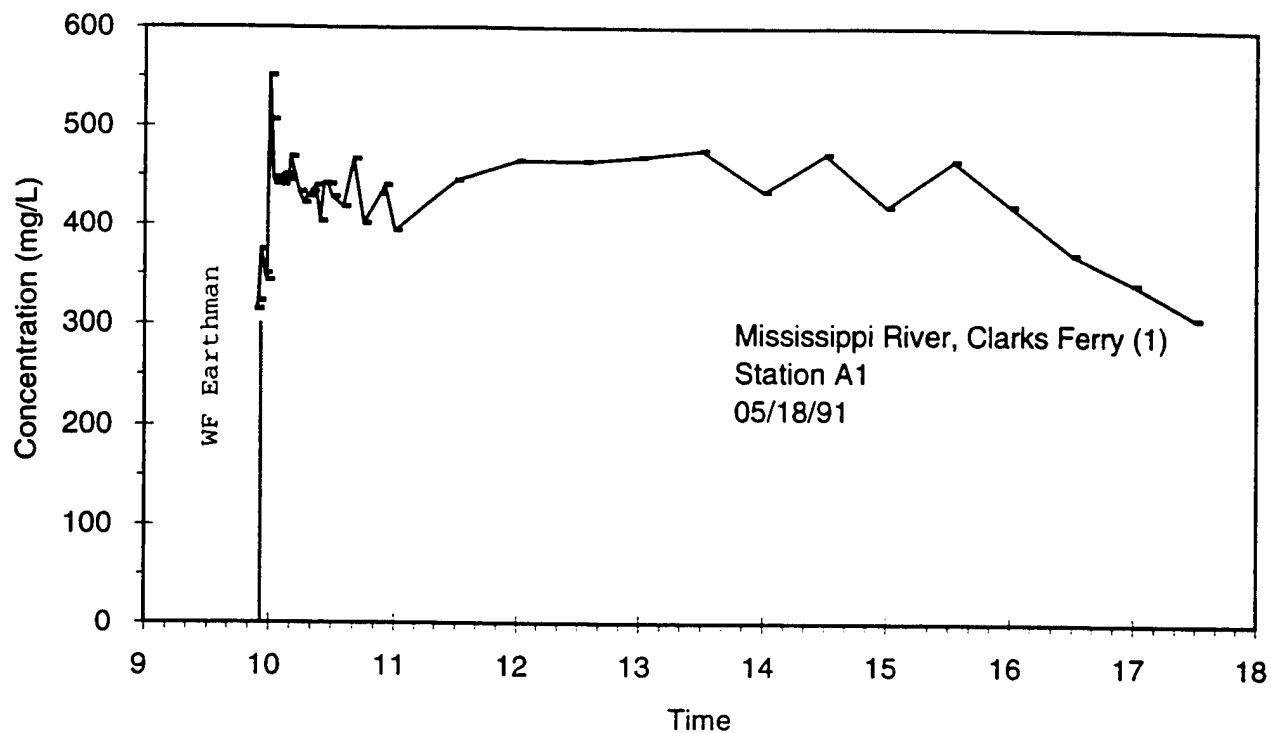
Location of suspended sediment sampling stations on the Mississippi River near the Clarks Ferry site during May 13-23, 1991 (trip 1)



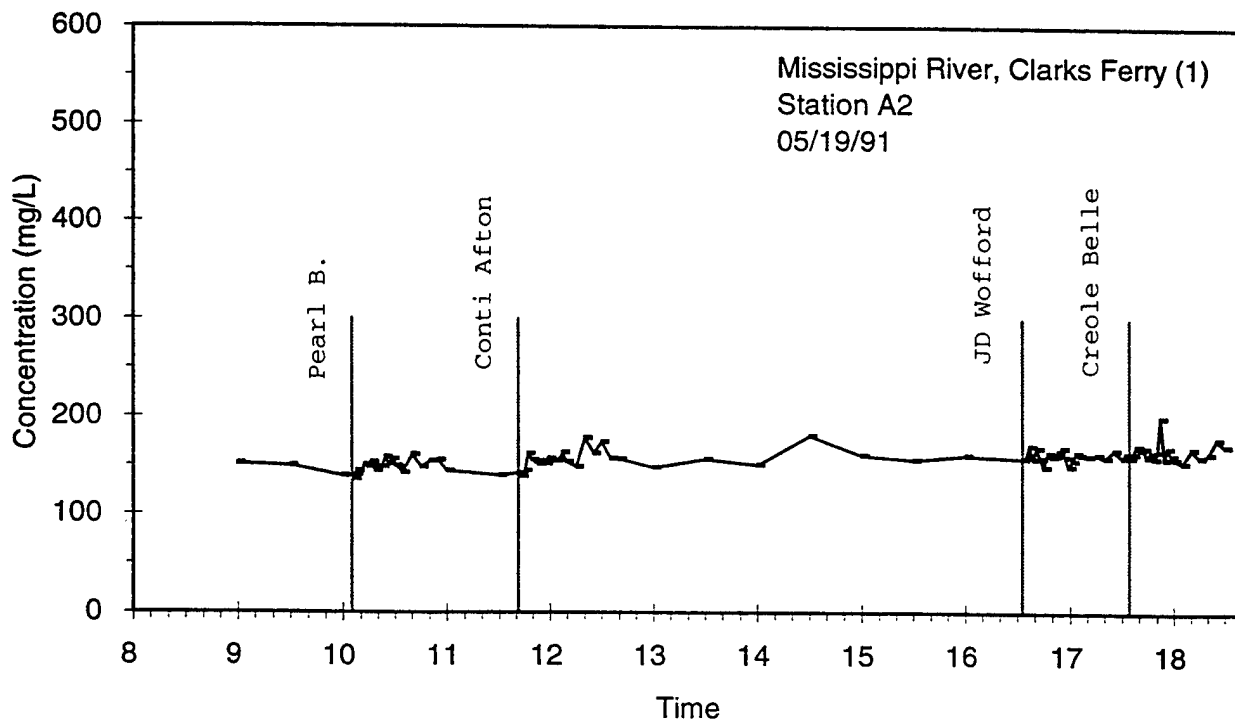
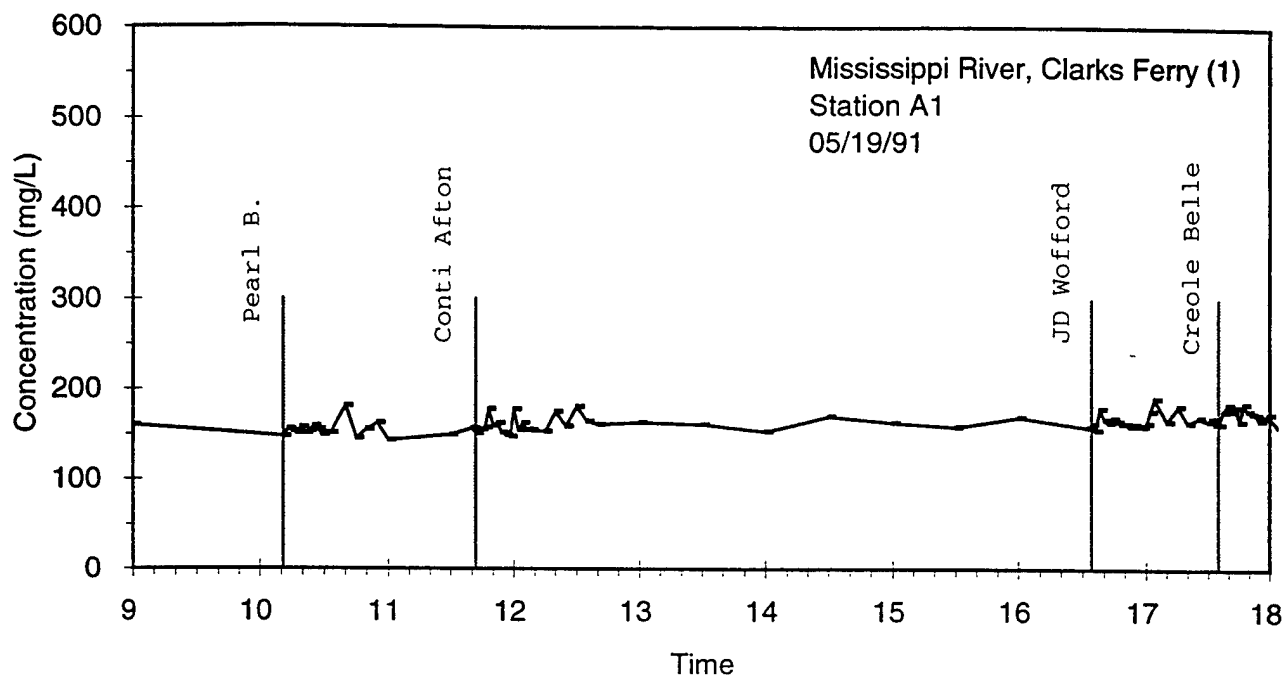
Station A1 May 17, 1991



Stations A1 and A2 May 18, 1991

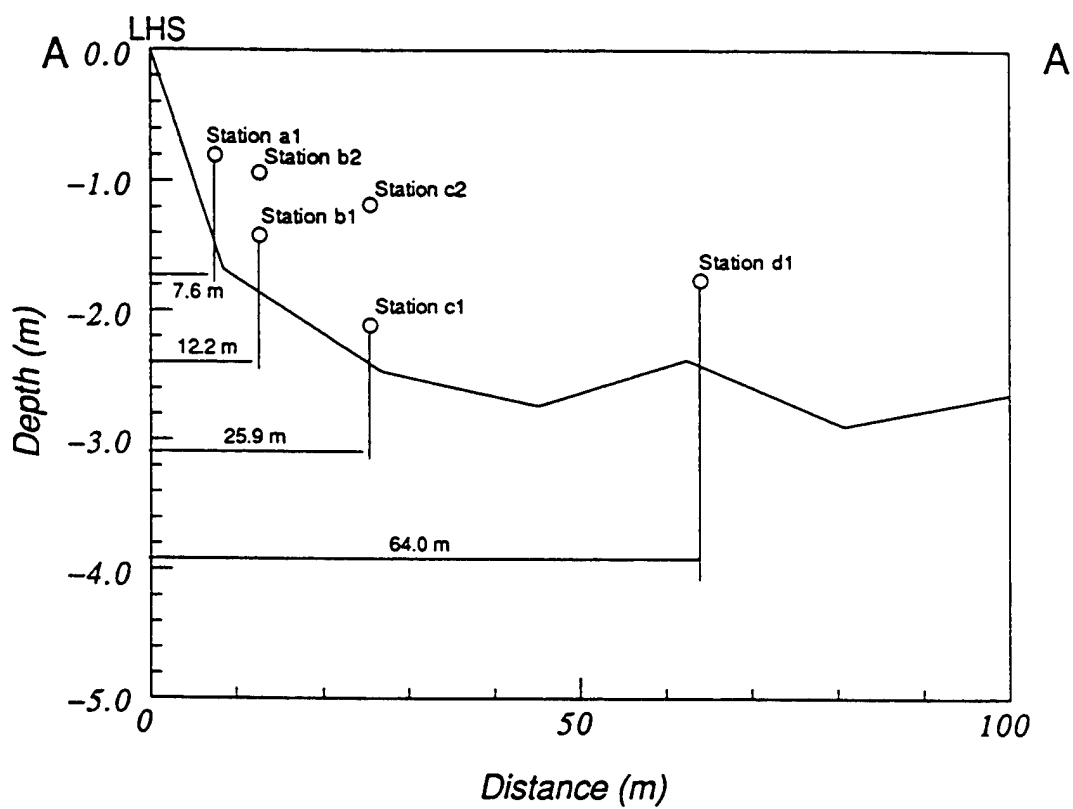


Stations A1 and A2 May 19, 1991

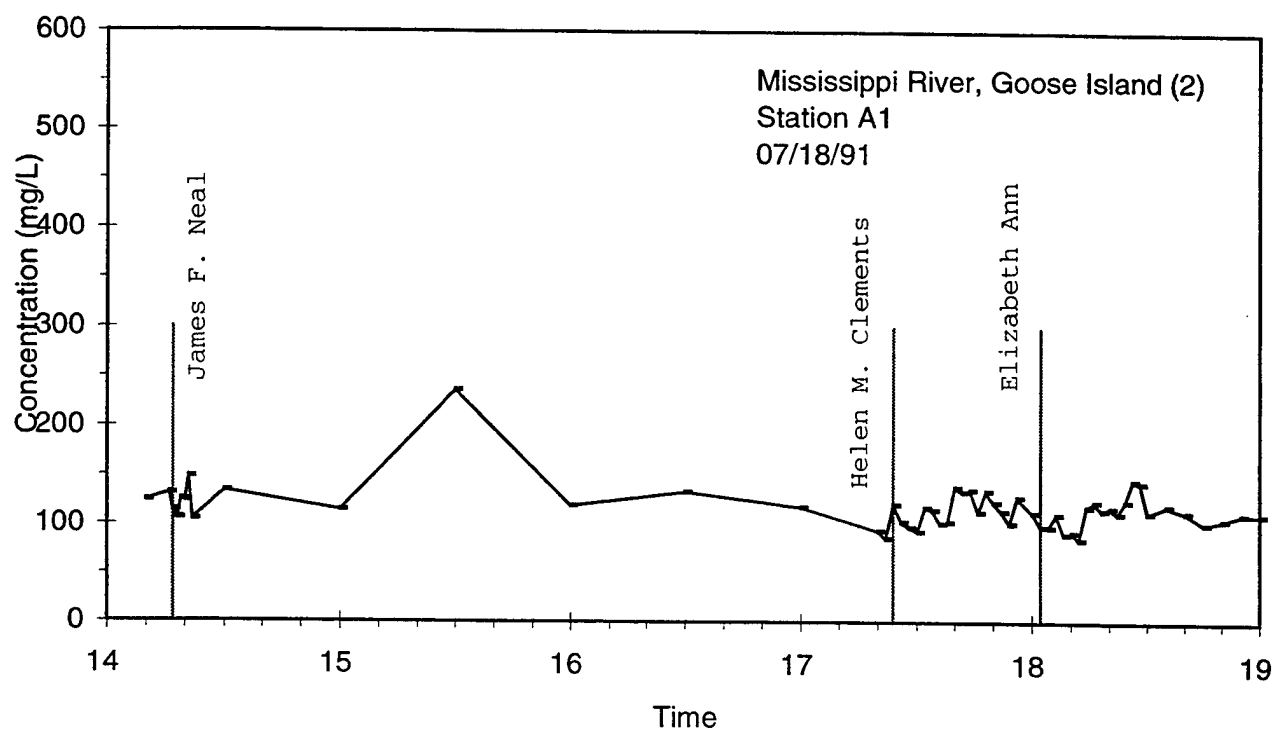


XXV-6. Variation of suspended sediment concentration with time, Goose Island, trip 2

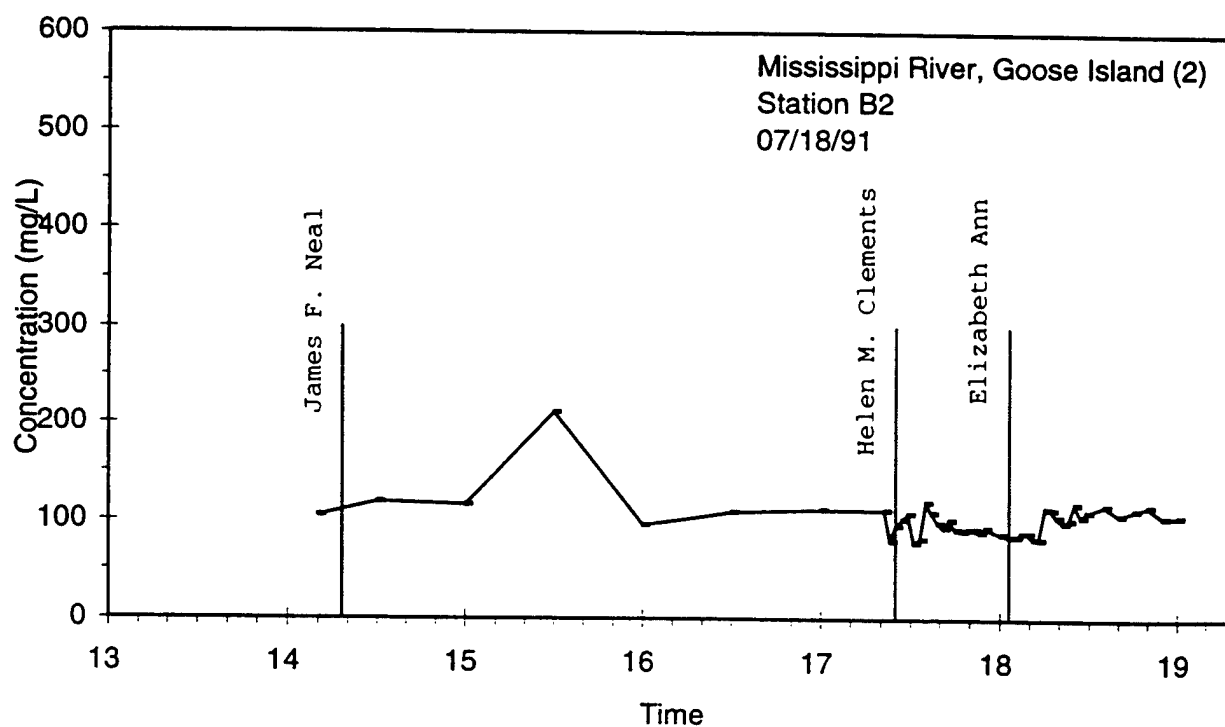
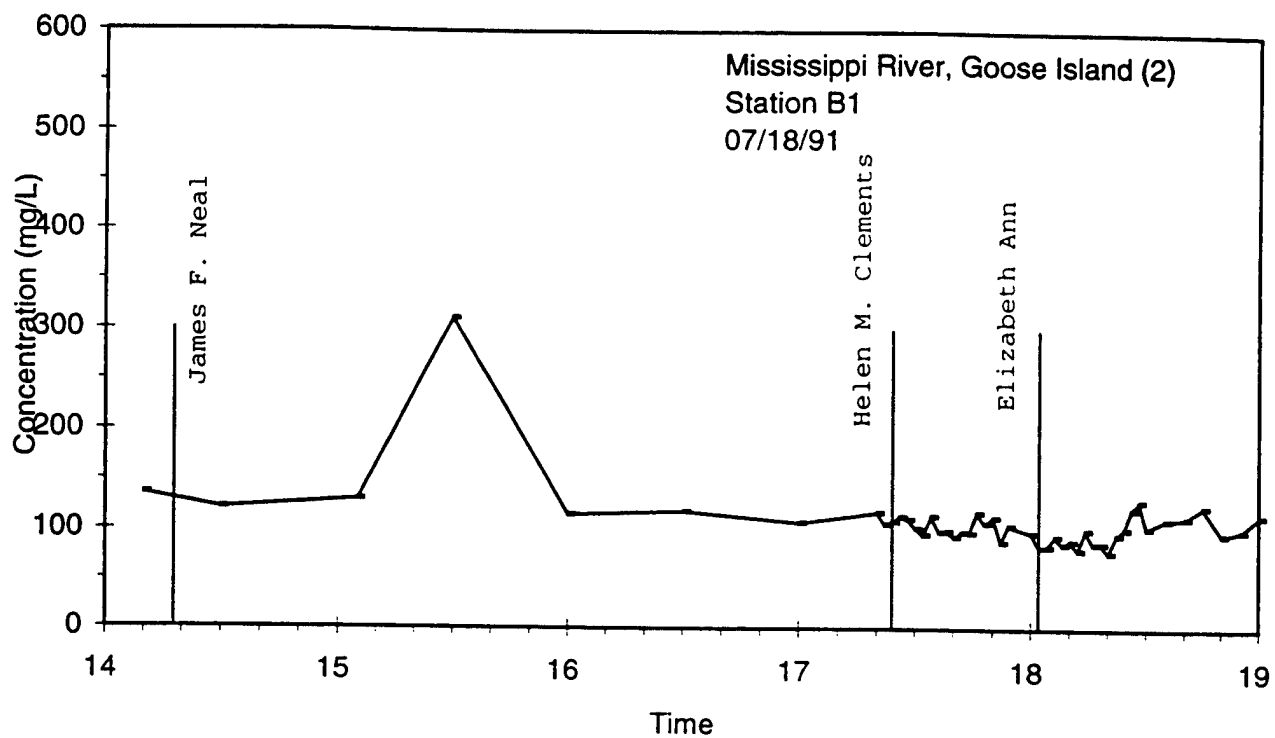
Location of suspended sediment sampling stations on the Mississippi River near the Goose Island site during July 15-25 (trip 2)



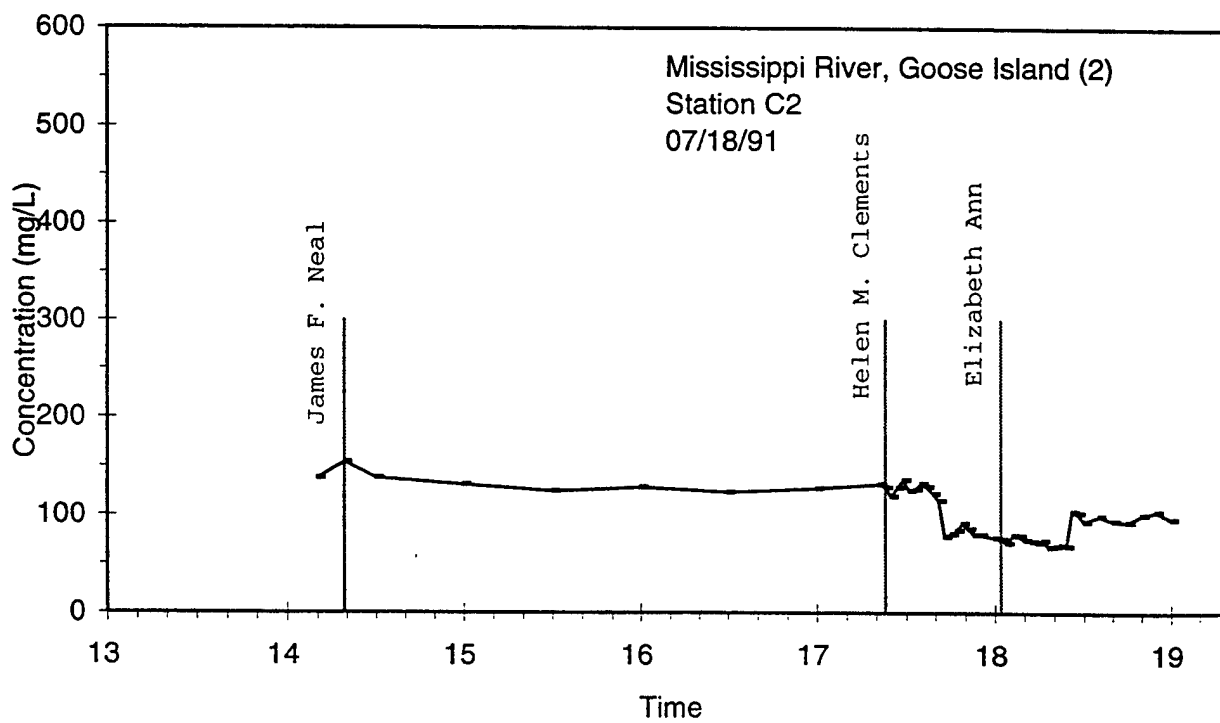
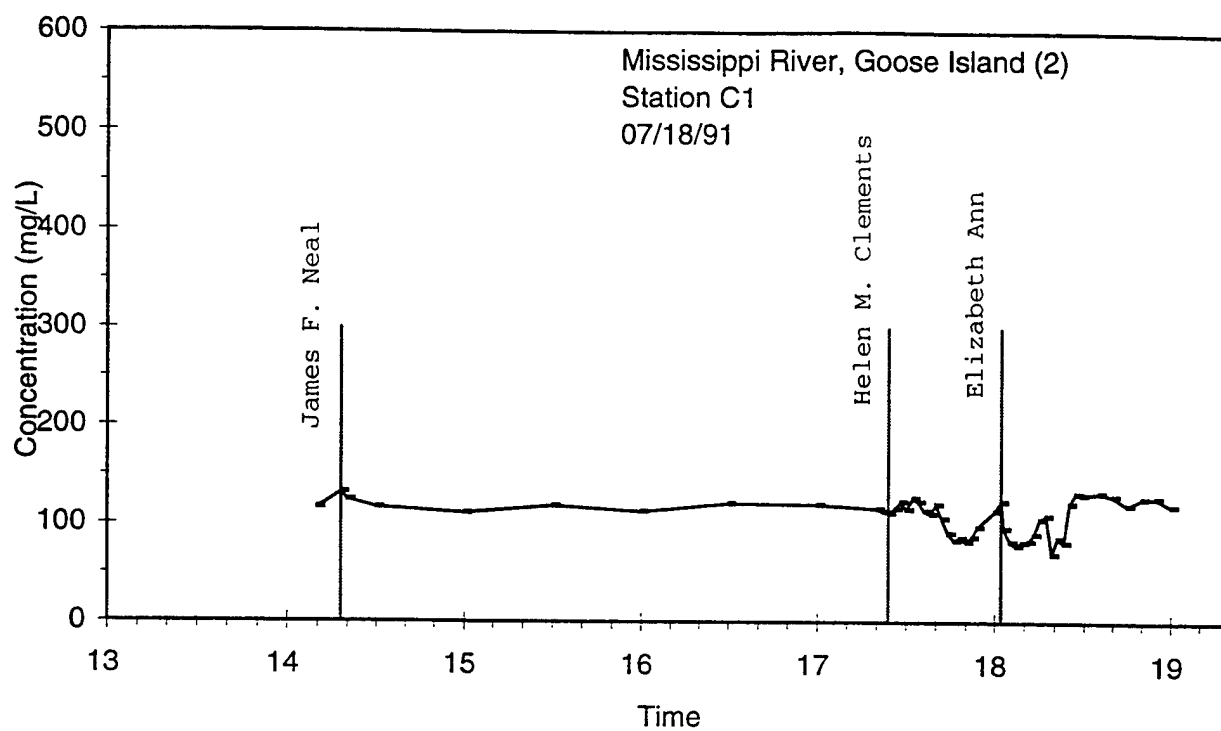
Station A1 July 18, 1991



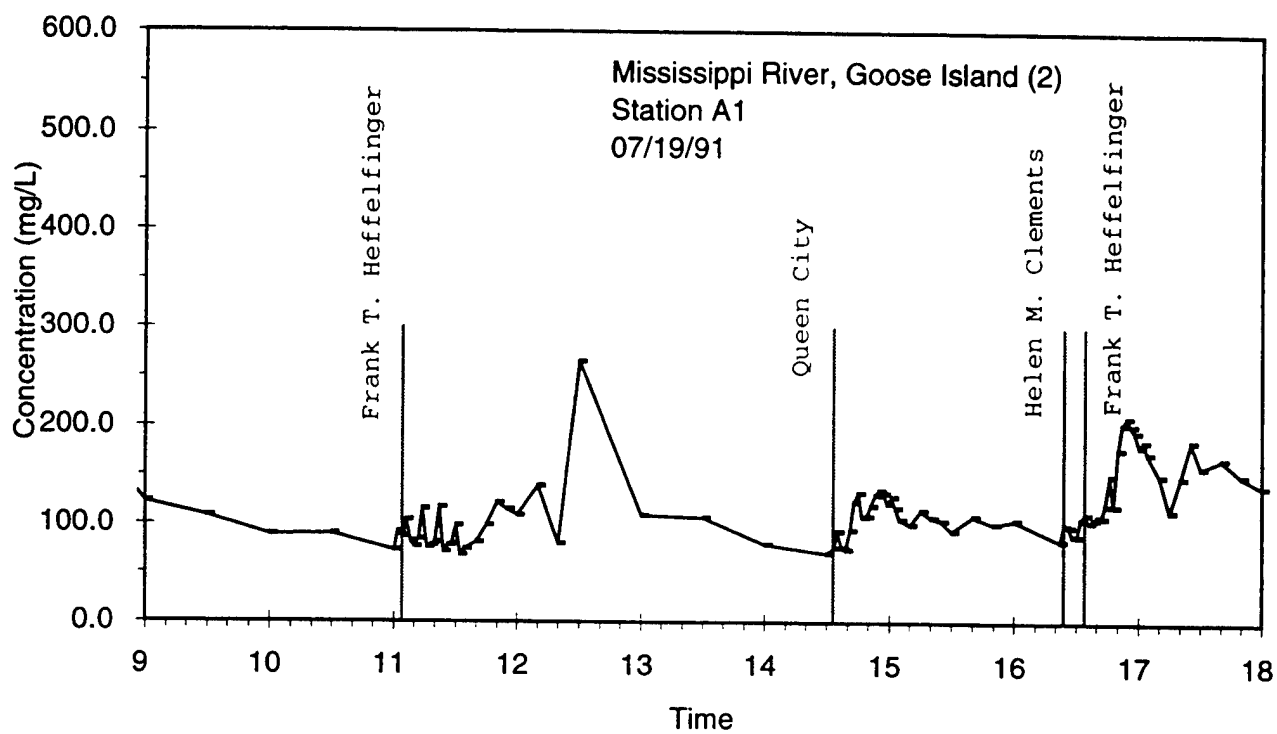
Stations B1 and B2 July 18, 1991



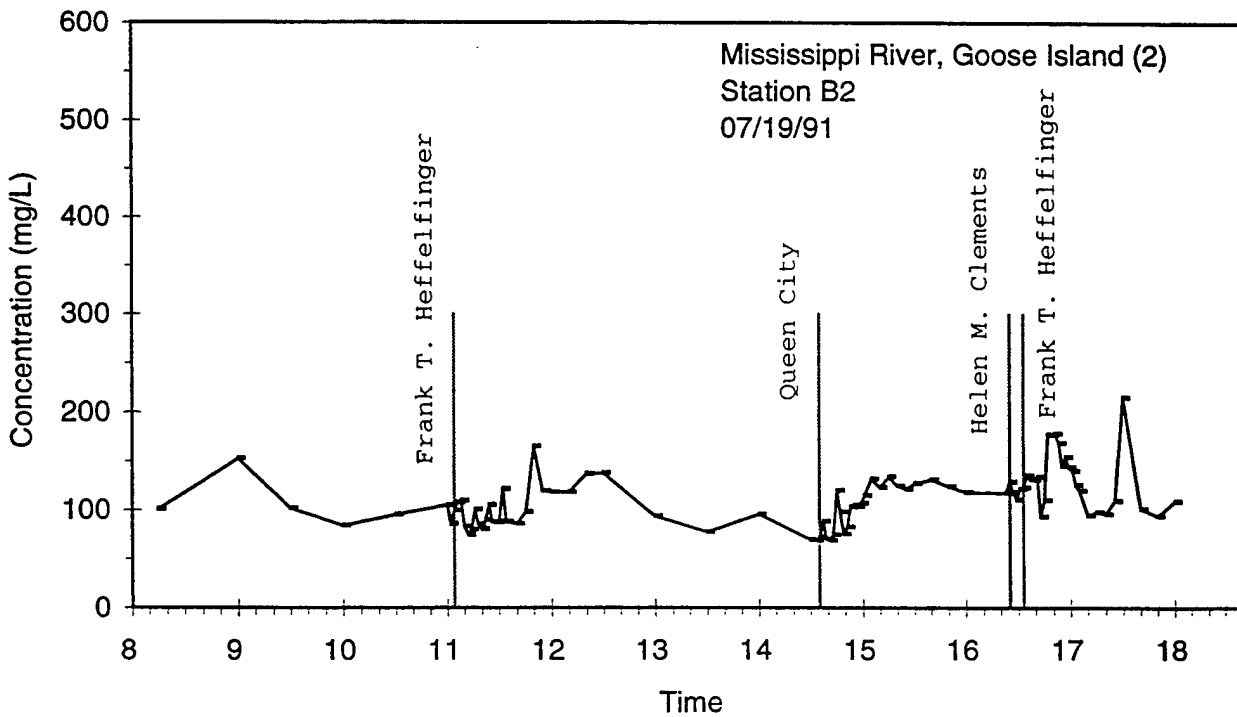
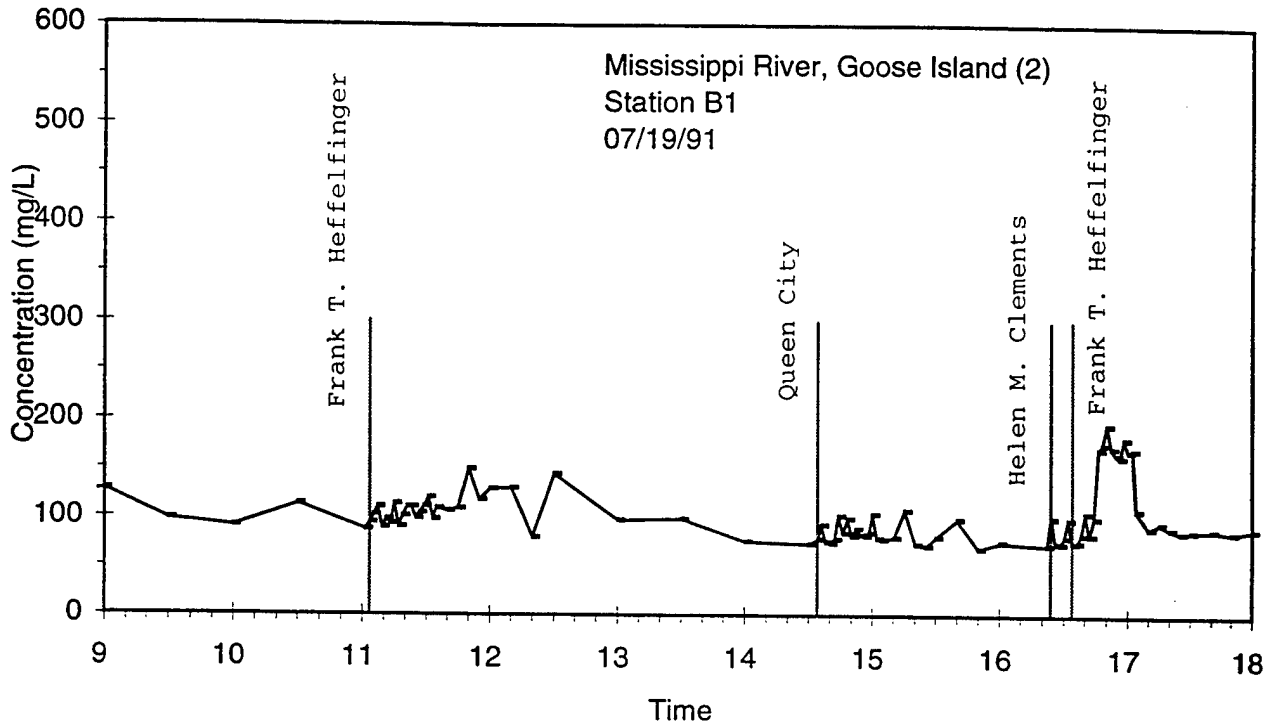
Stations C1 and C2 July 18, 1991



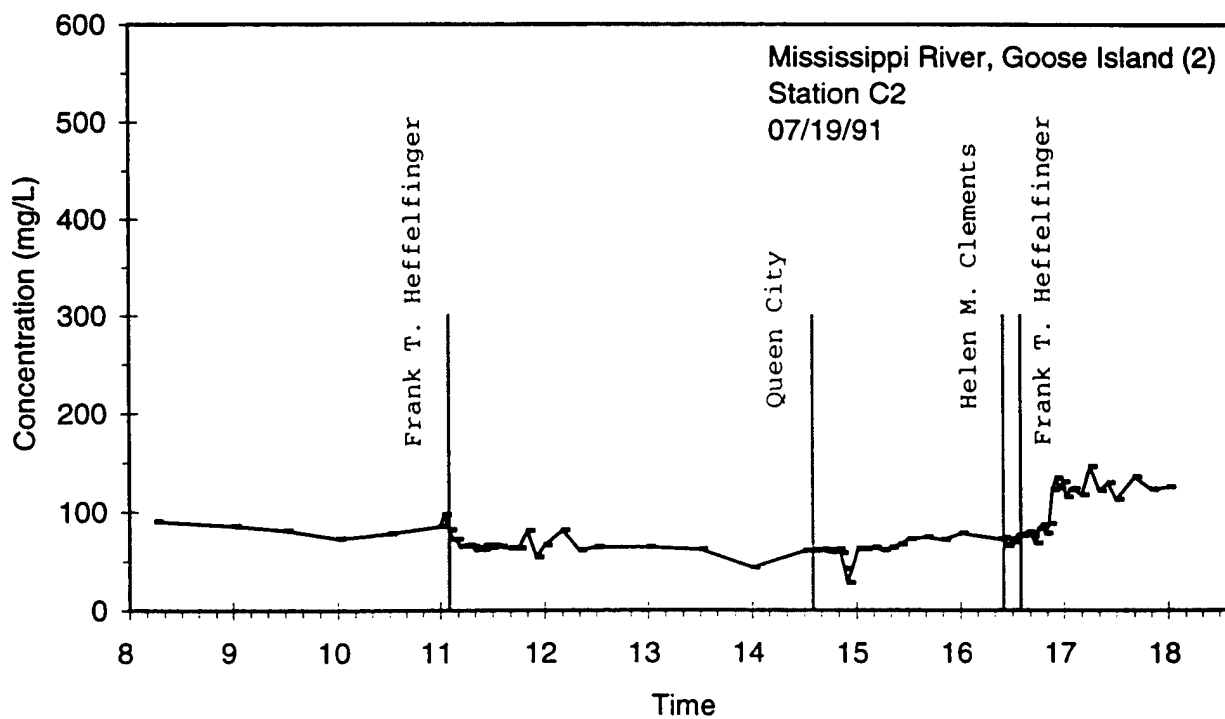
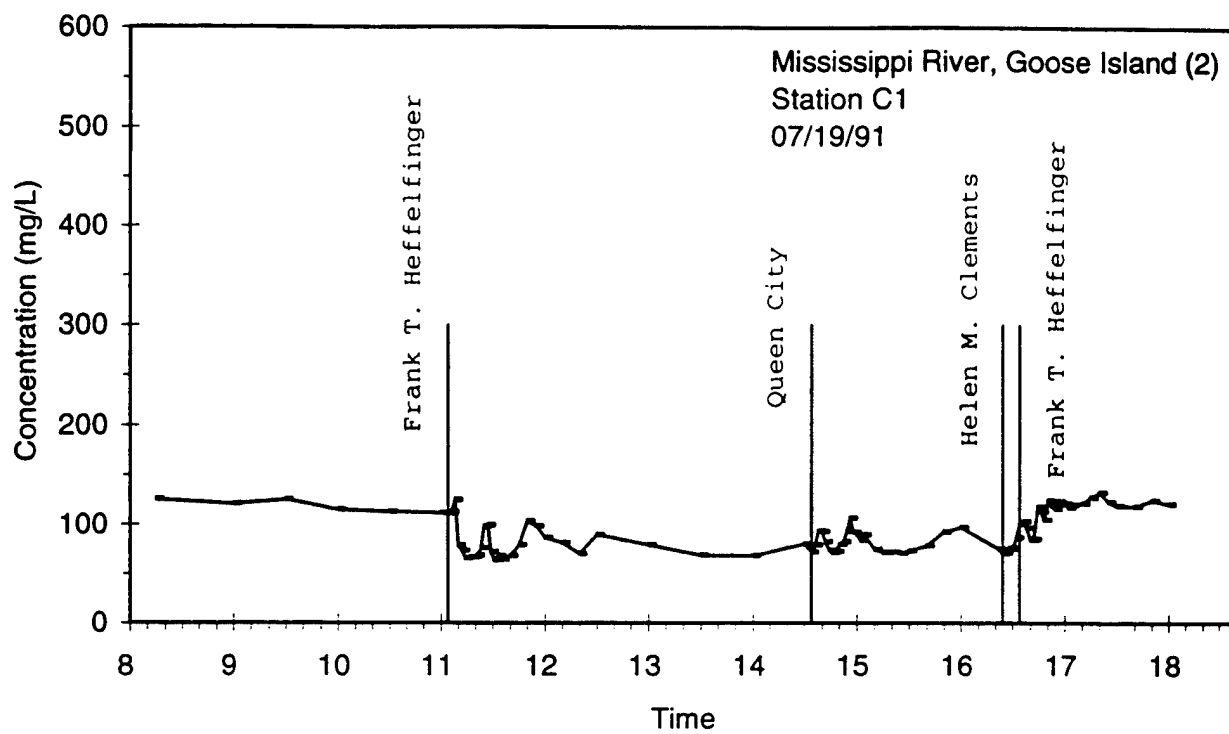
Station A1 July 19, 1991



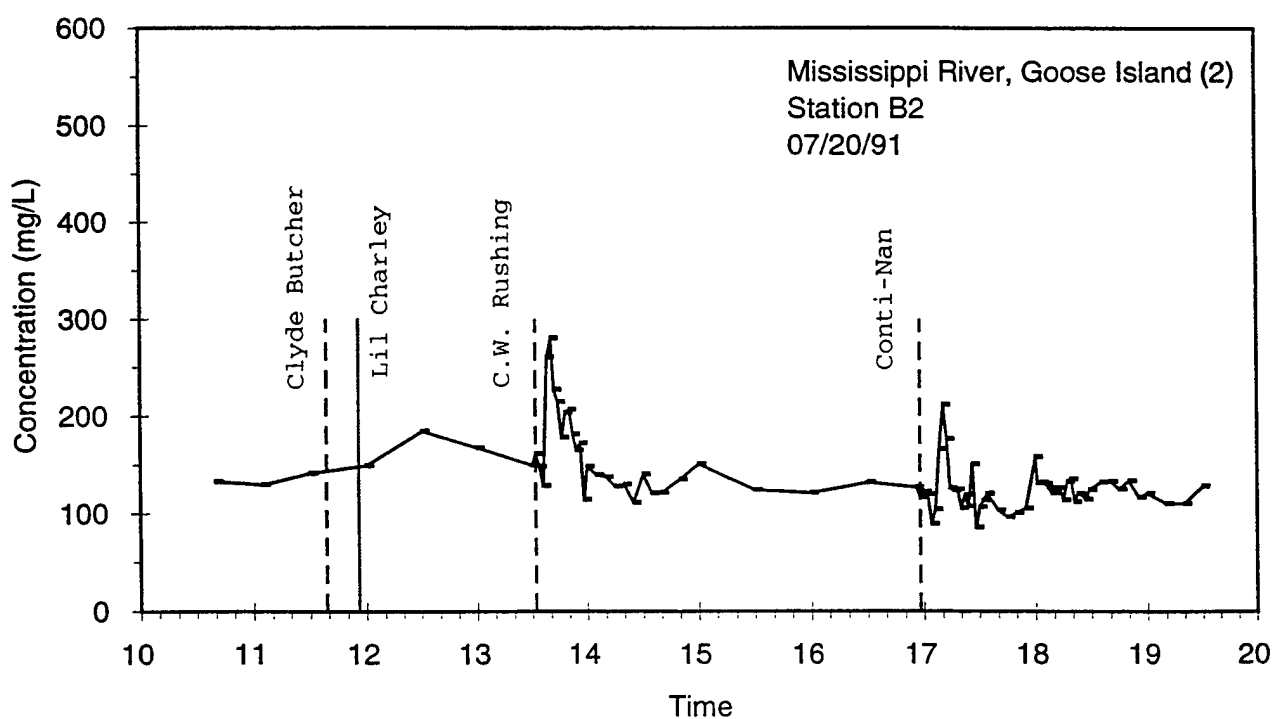
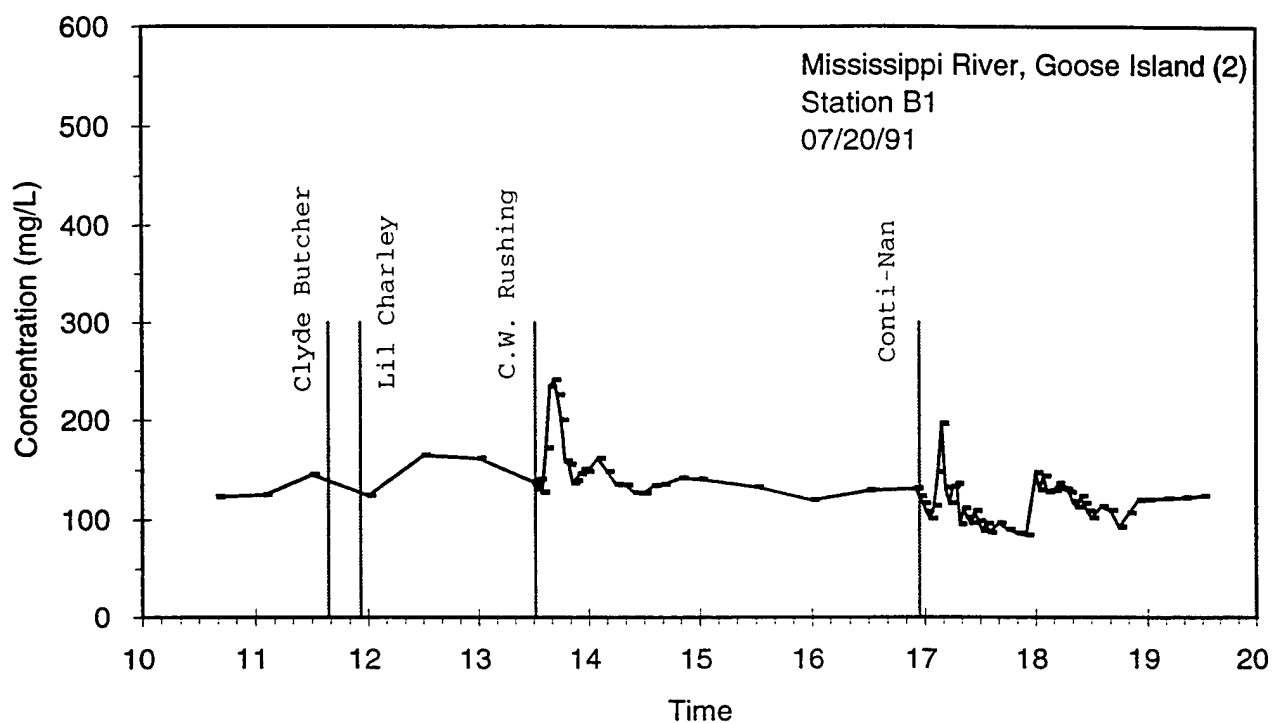
Stations B1 and B2 July 19, 1991



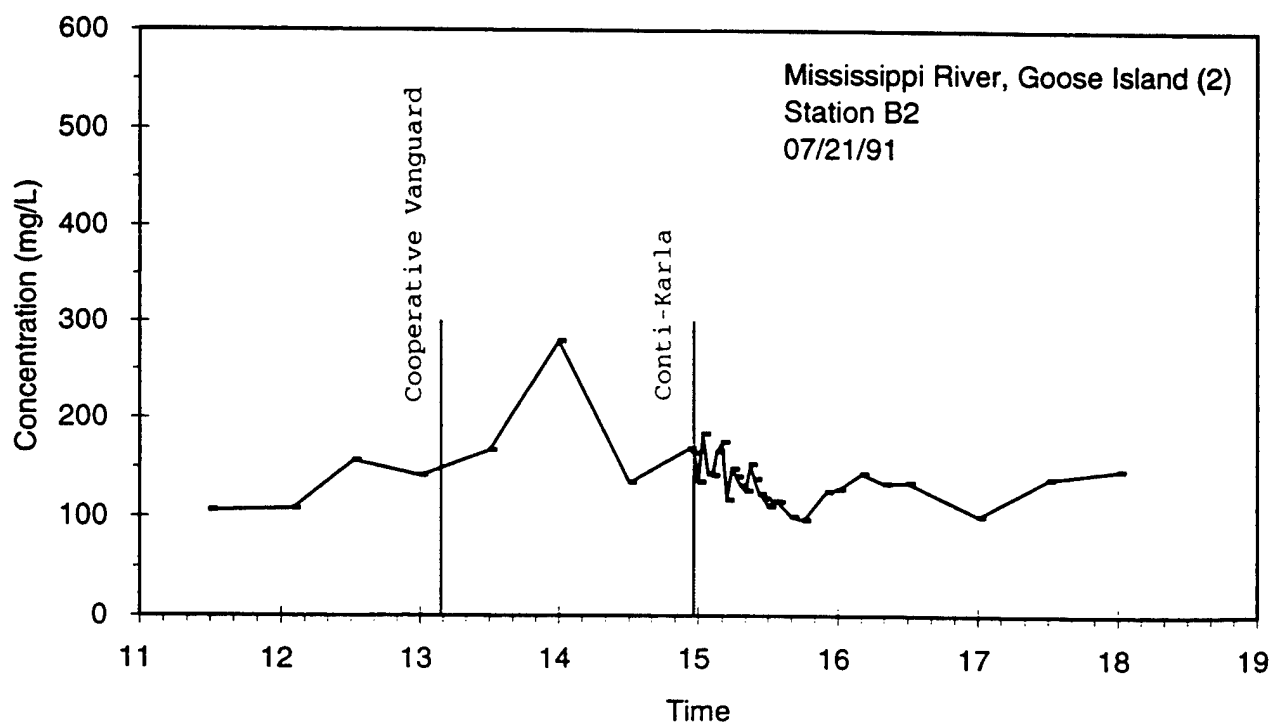
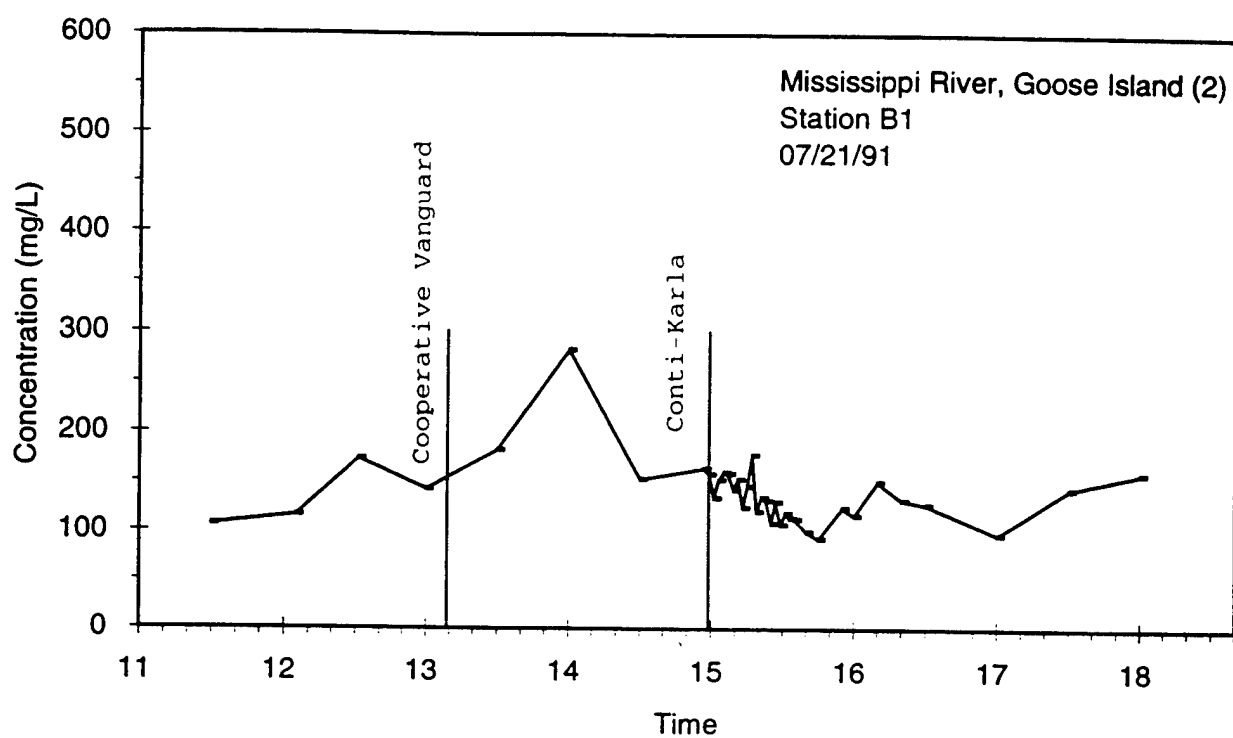
Stations C1 and C2 July 19, 1991



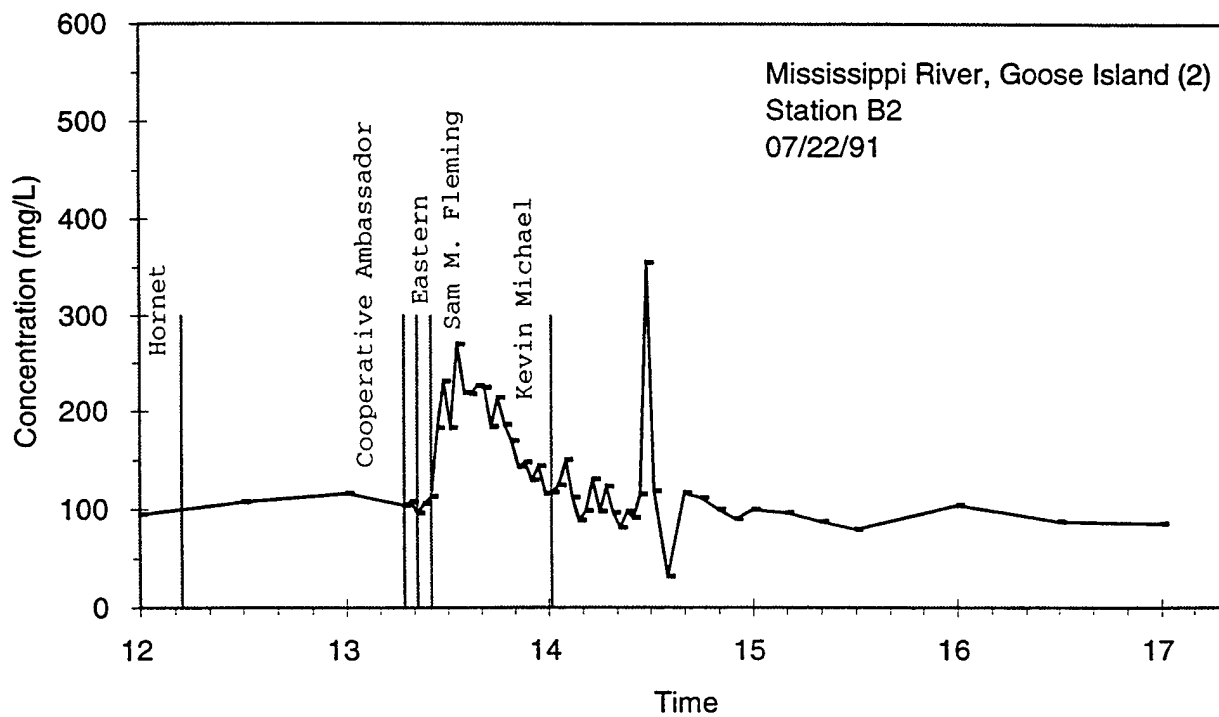
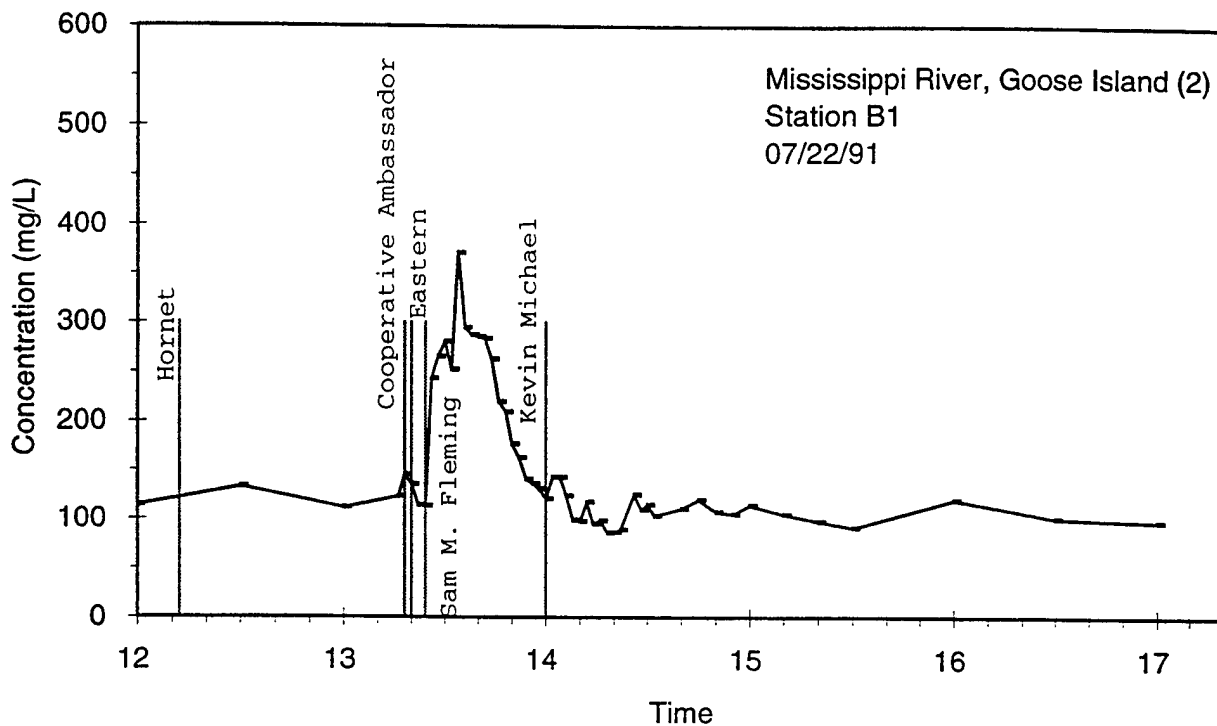
Stations B1 and B2 July 20, 1991



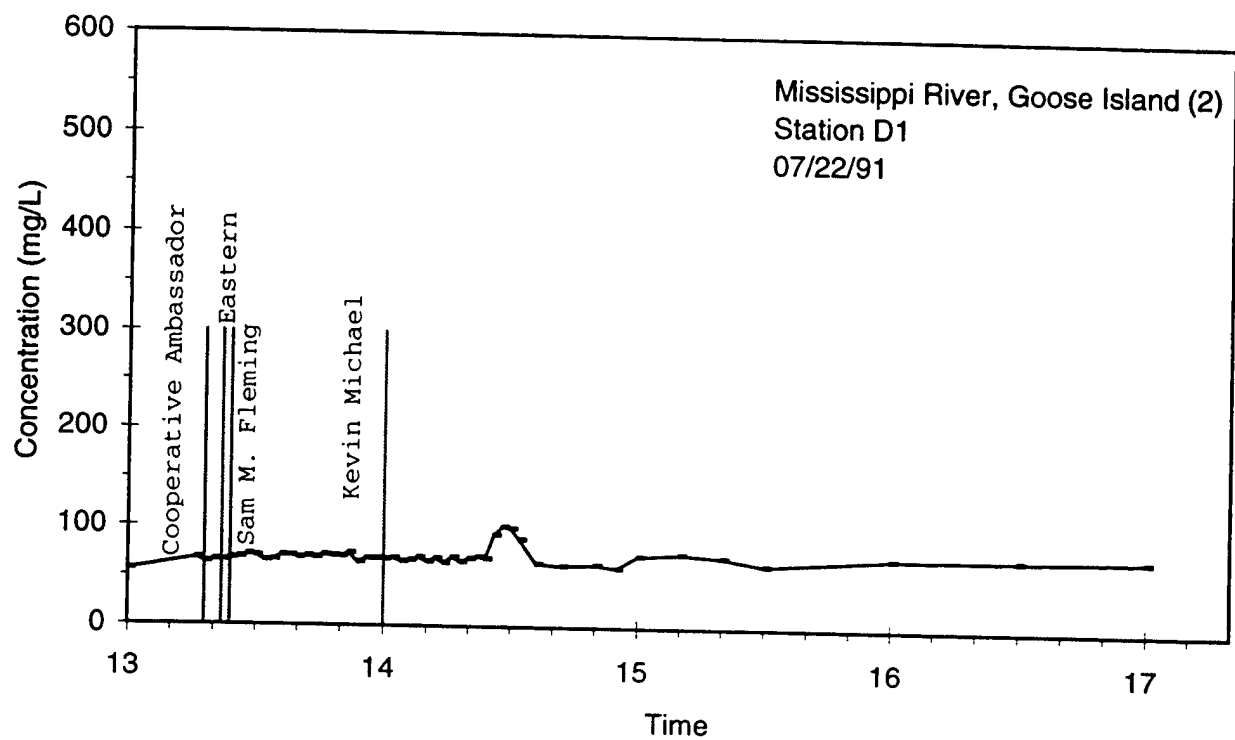
Stations B1 and B2 July 21, 1991



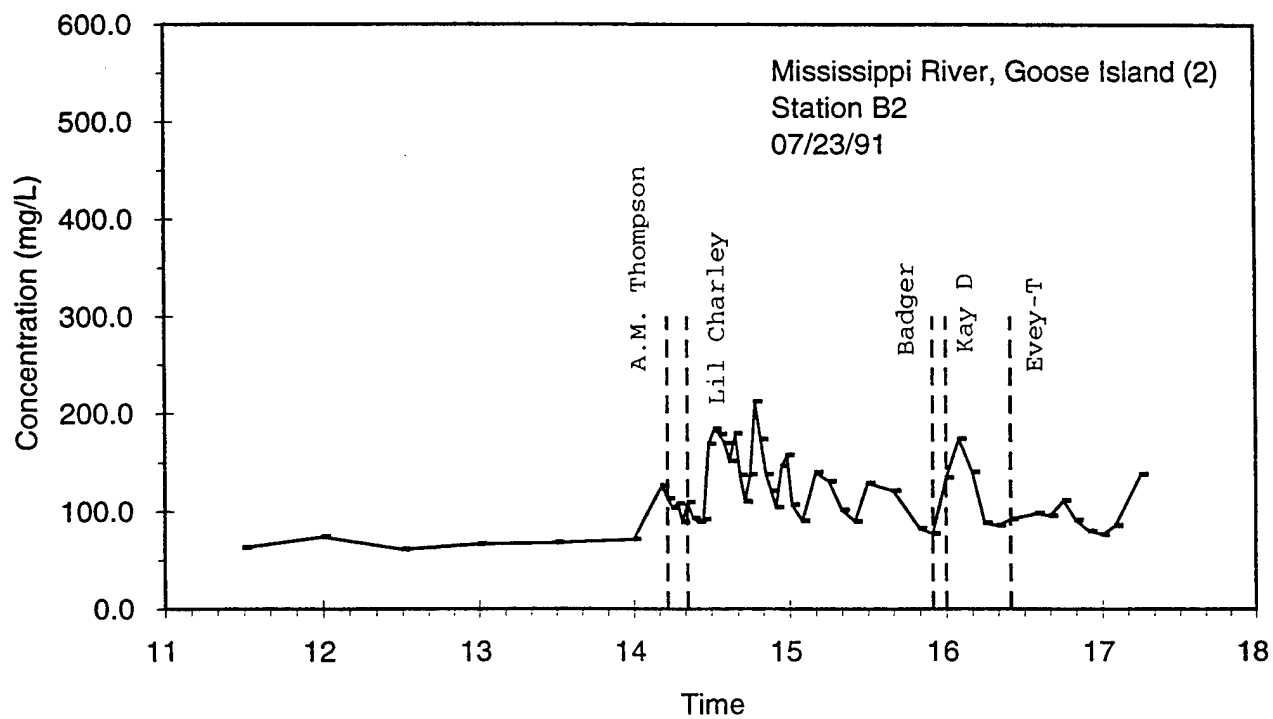
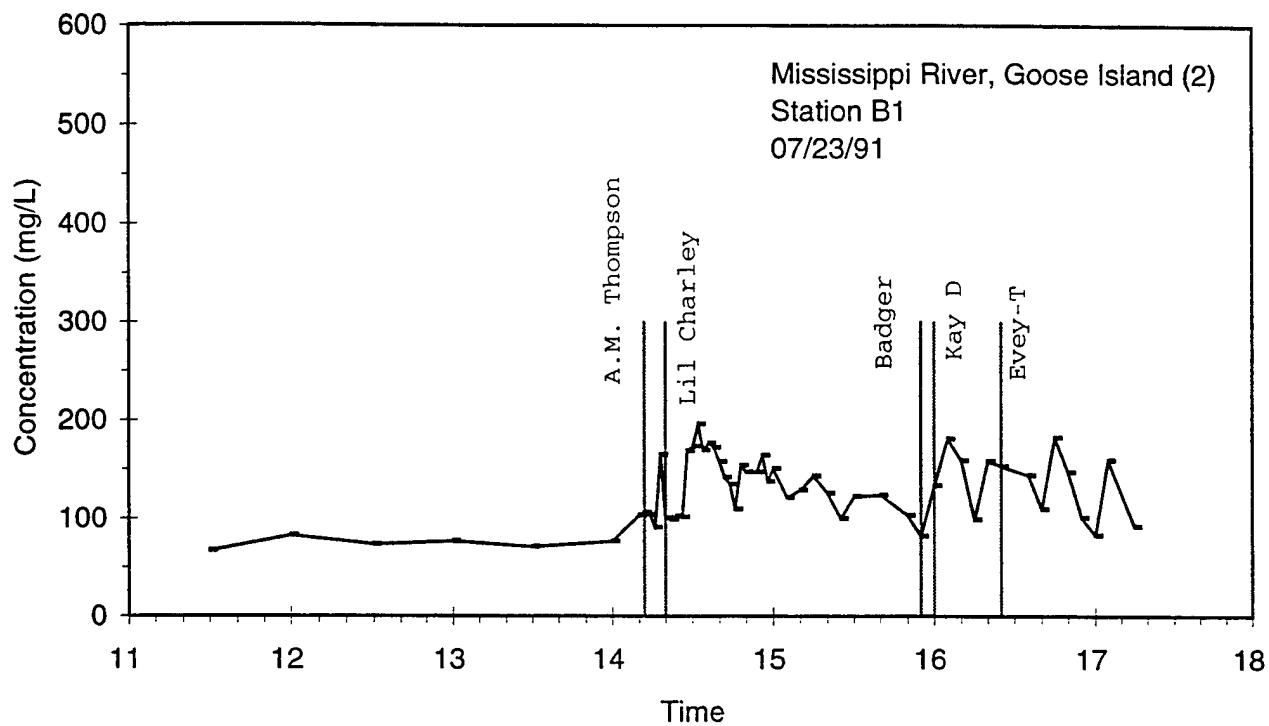
Stations B1 and B2 July 22, 1991



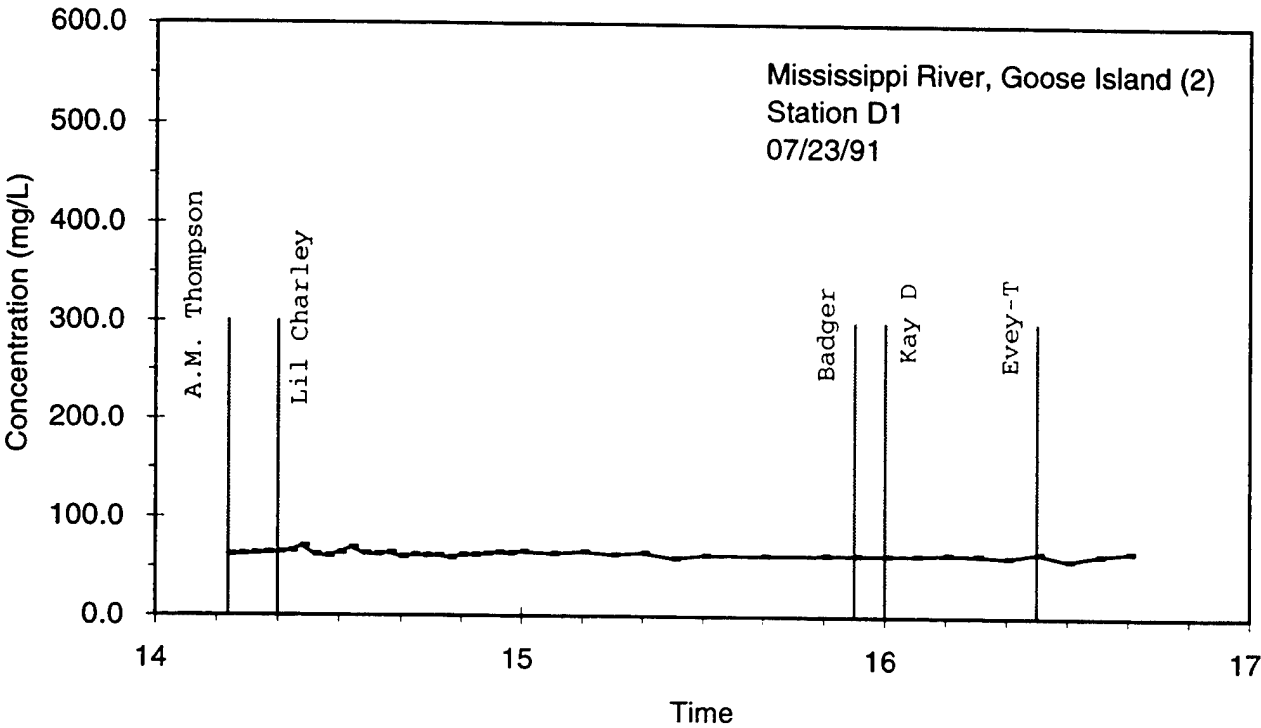
Station D1 July 22, 1991



Stations B1 and B2 July 23, 1991

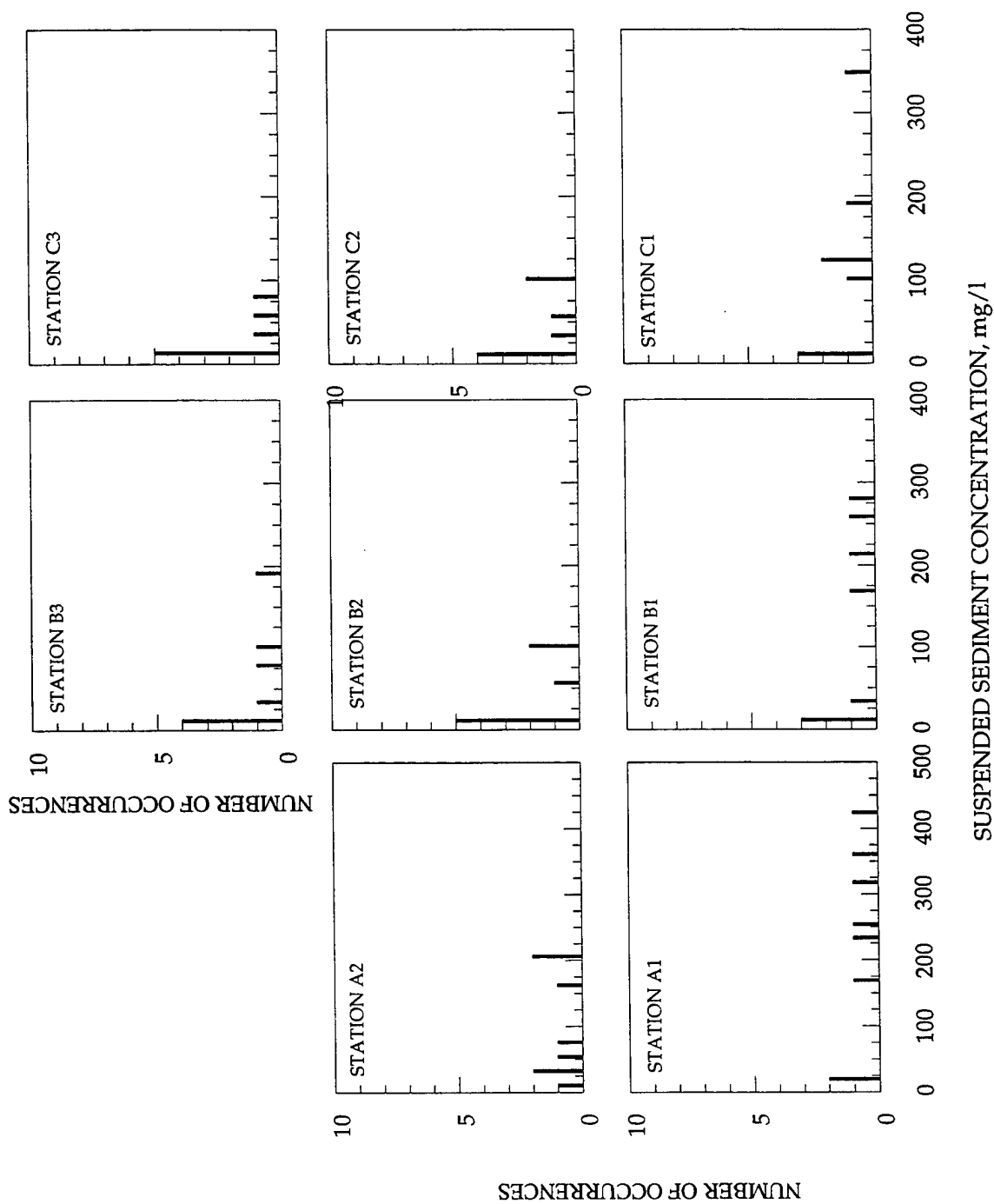


Station D1 July 23, 1991



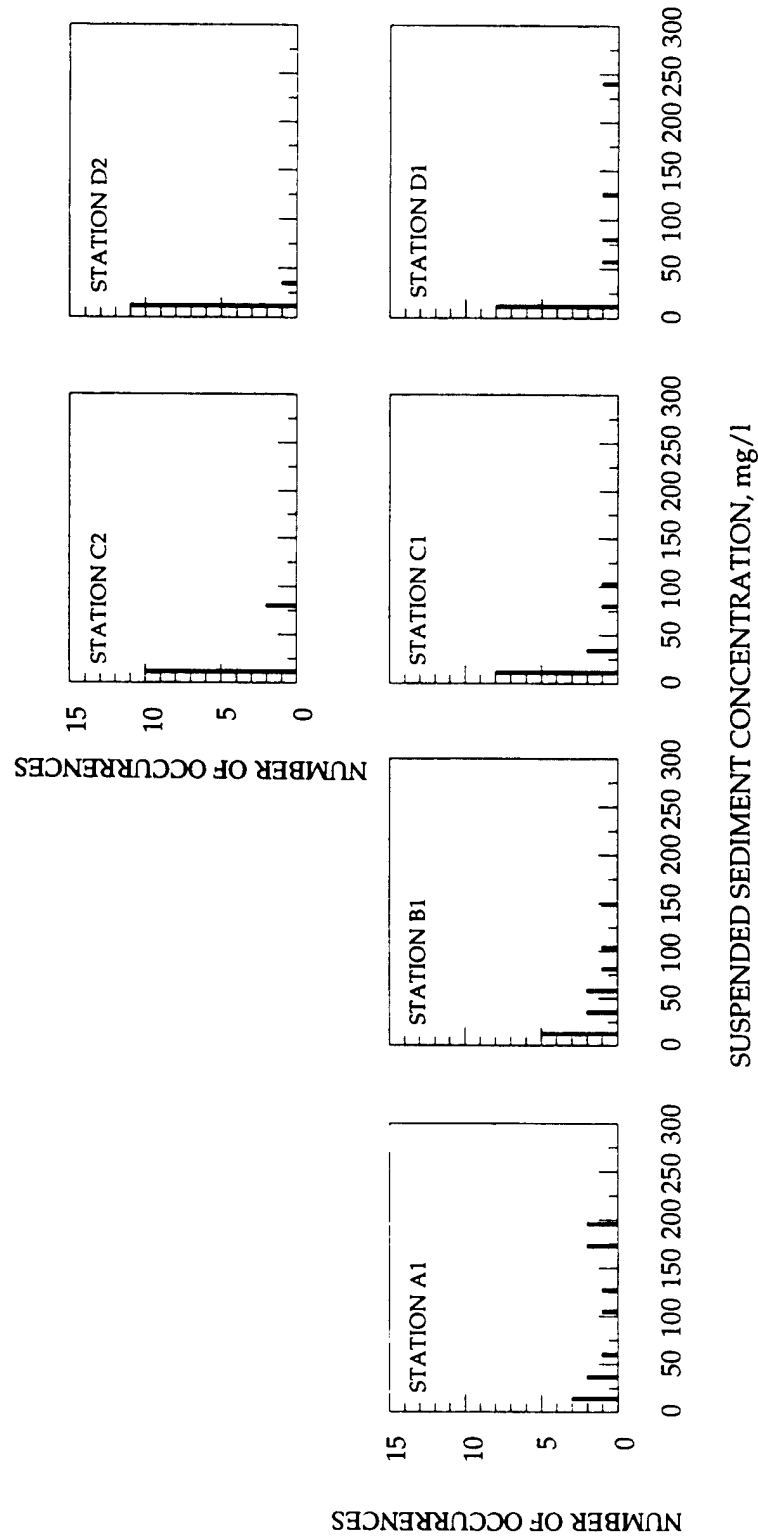
APPENDIX XXVI.
HISTOGRAMS OF SUSPENDED SEDIMENT CONCENTRATION

McEVER'S ISLAND



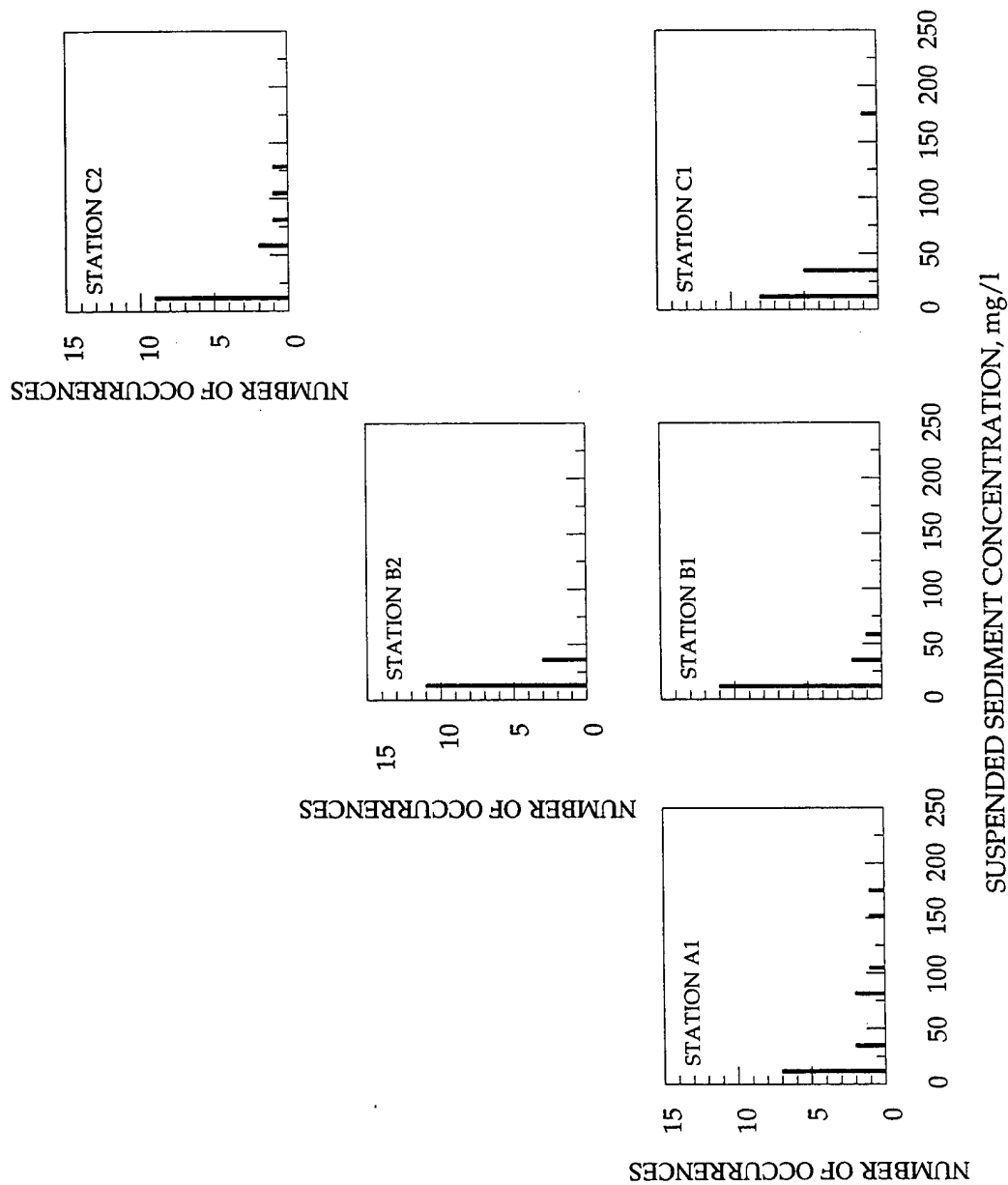
XXVI-1. Histograms of maximum increased suspended sediment concentration, McEver's Island

APPLE RIVER ISLAND



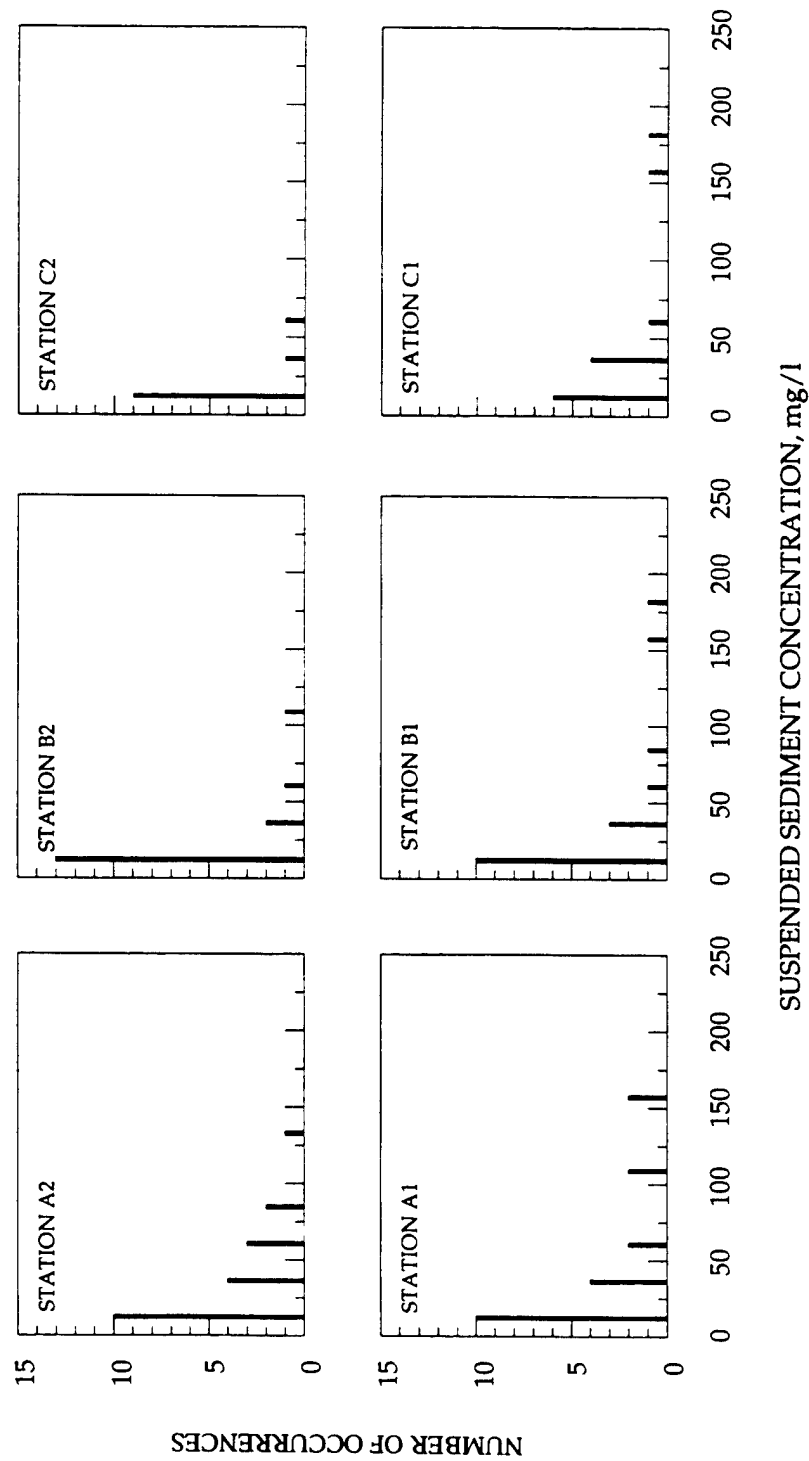
XXVI-2. Histograms of maximum increased suspended sediment concentration, Apple River Island

GOOSE ISLAND, TRIP 1



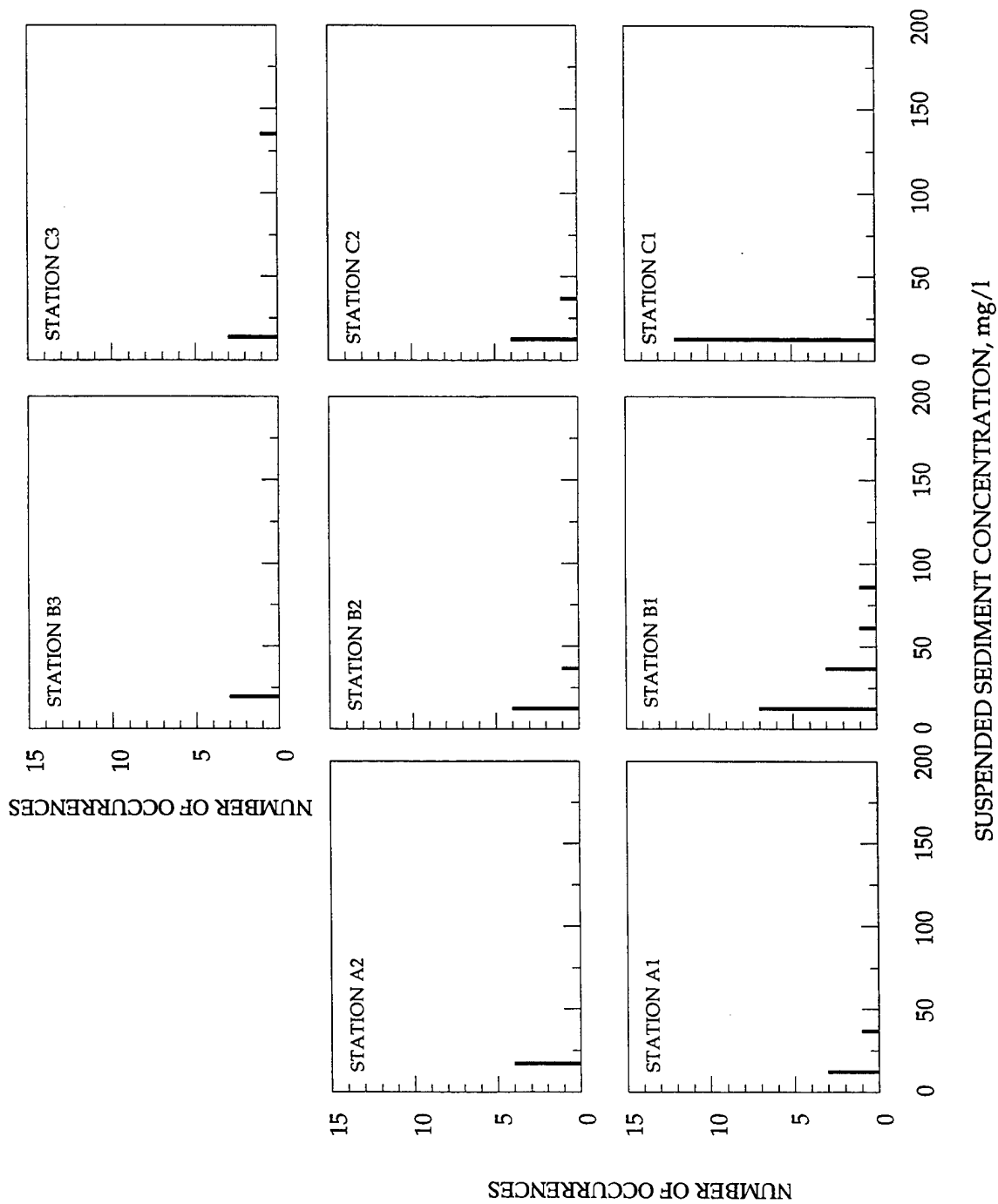
XXVI-3. Histograms of maximum increased suspended sediment concentration, Goose Island, trip 1

KAMPSVILLE, TRIP 1



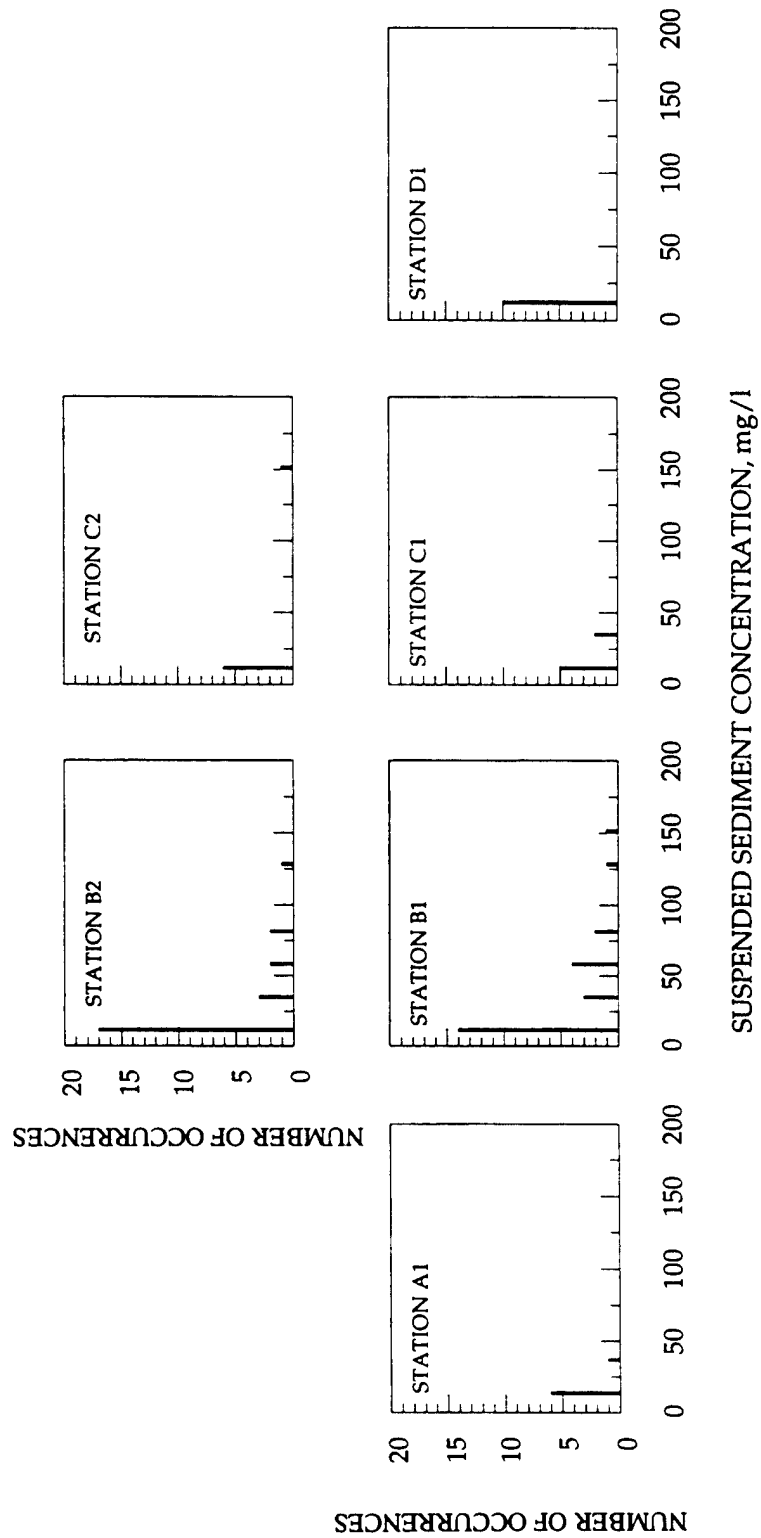
XXVI-4. Histograms of maximum increased suspended sediment concentration, Kampsville, trip 1

CLARKS FERRY, TRIP 1



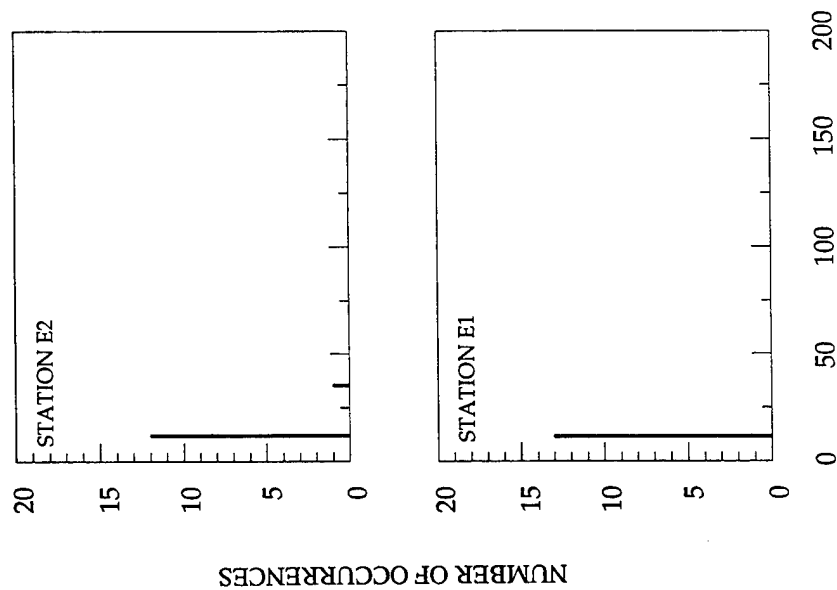
XXVI-5. Histograms of maximum increased suspended sediment concentration, Clarks Ferry, trip 1

GOOSE ISLAND, TRIP 2



XXVI-6. Histograms of maximum increased suspended sediment concentration, Goose Island, trip 2

GOOSE ISLAND, TRIP 2

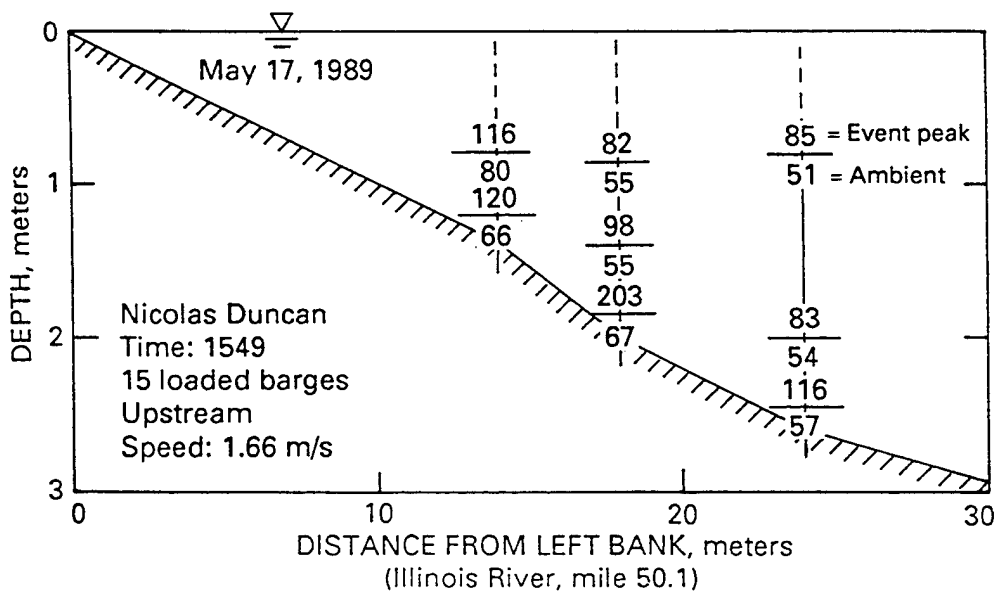
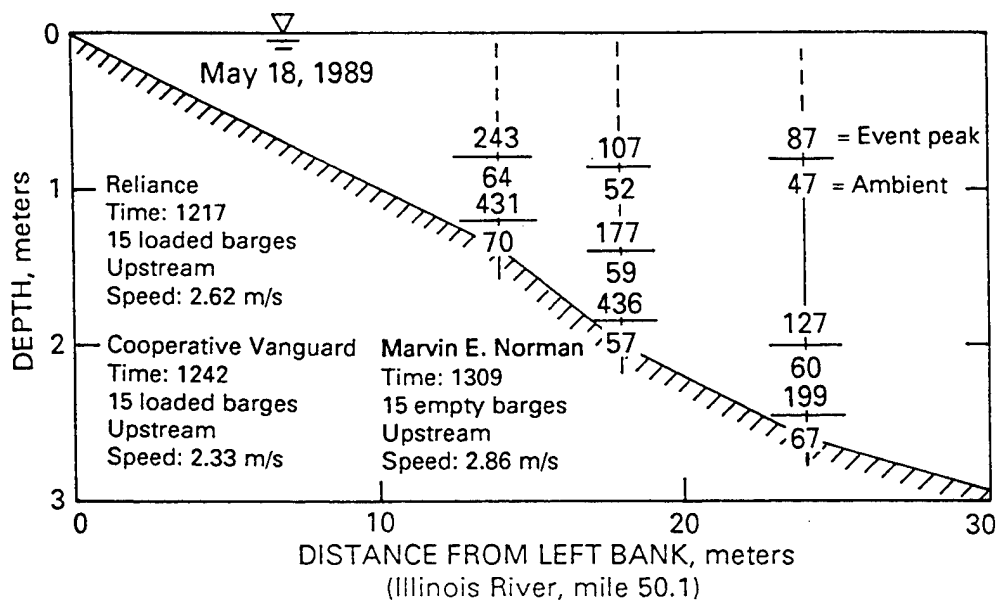


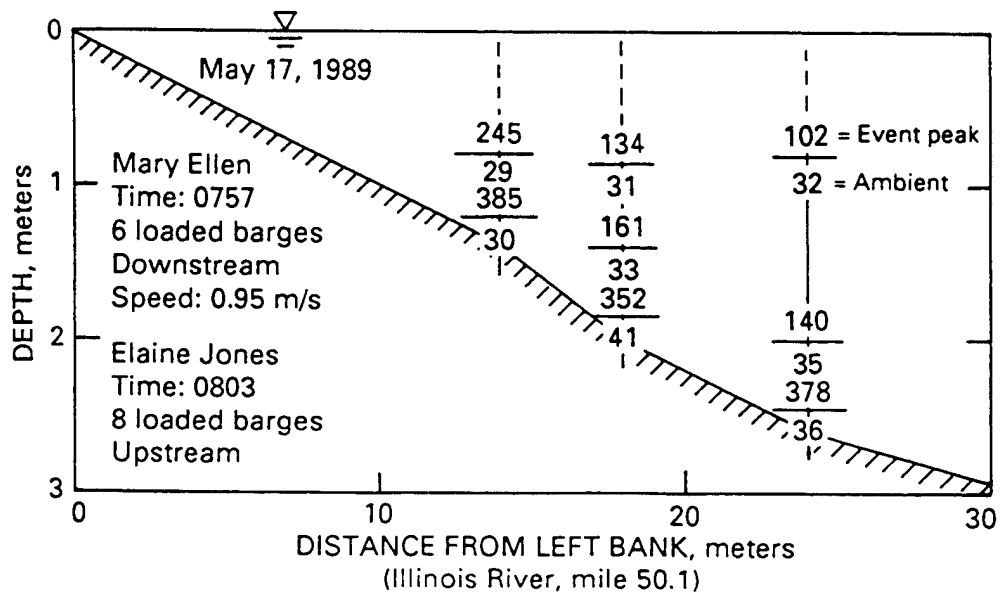
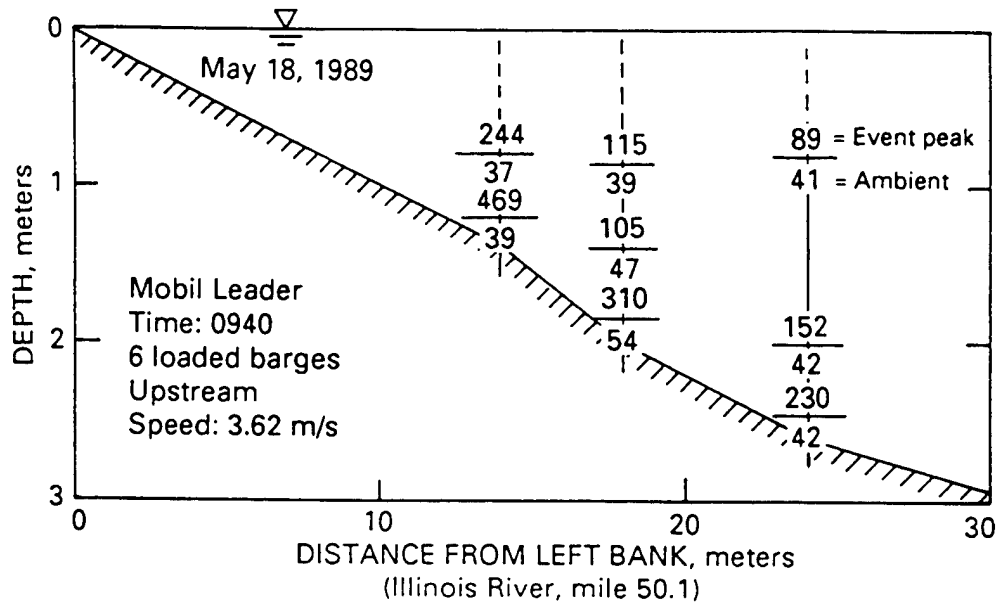
SUSPENDED SEDIMENT CONCENTRATION, mg/l

XXVI-6. Concluded

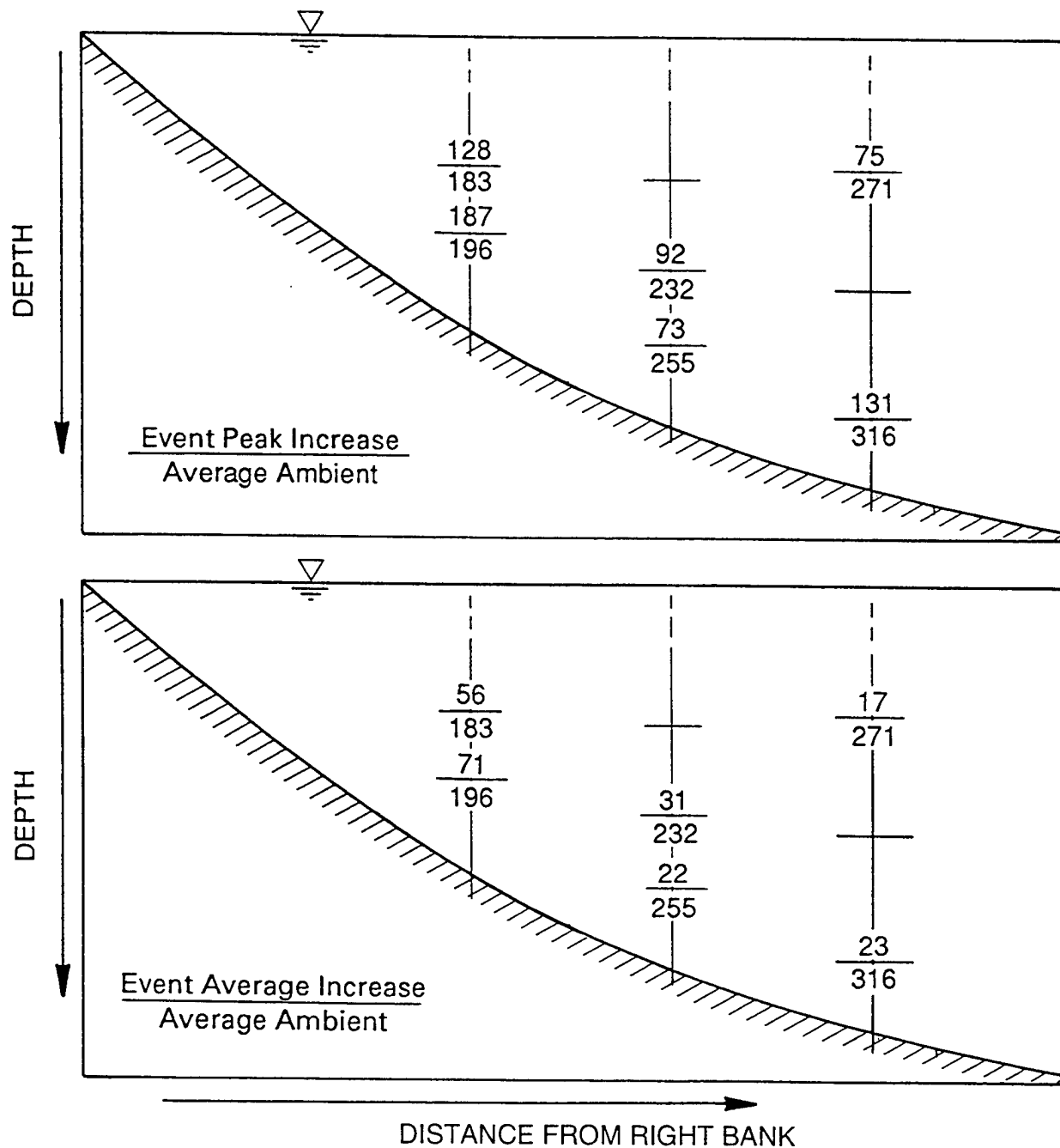
APPENDIX XXVII.

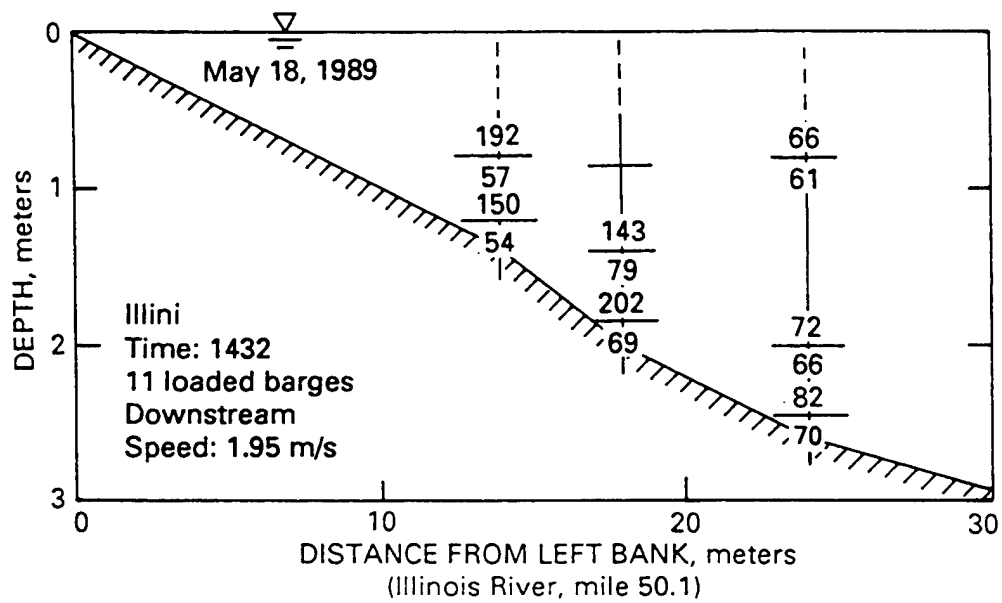
**RATIO OF PEAK TO AVERAGE SUSPENDED SEDIMENT CONCENTRATION
DUE TO MOVEMENT OF NAVIGATION TRAFFIC**



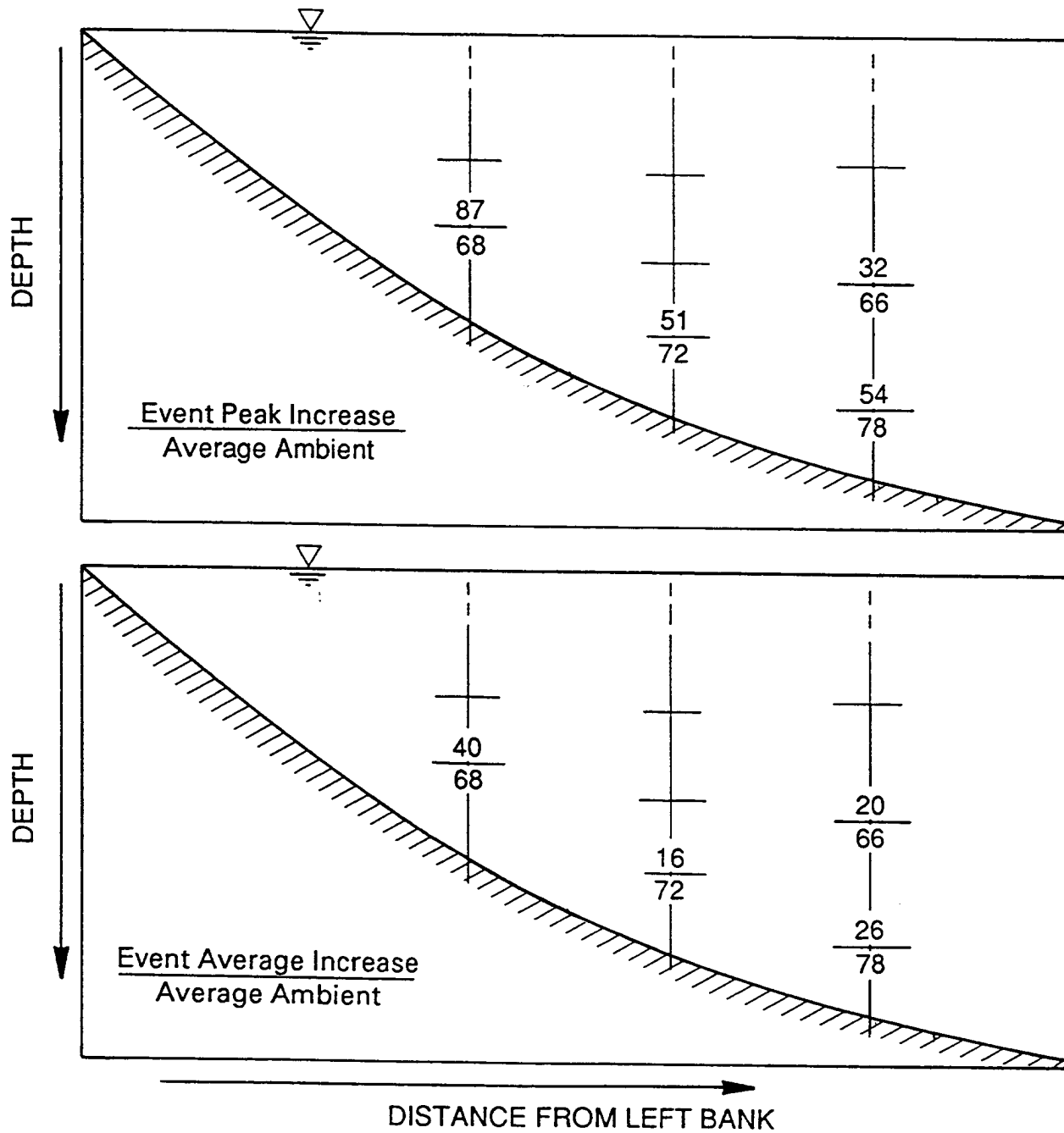


Illinois River, mile 35.3, October 1990
Average Suspended Sediment Concentrations, mg/L

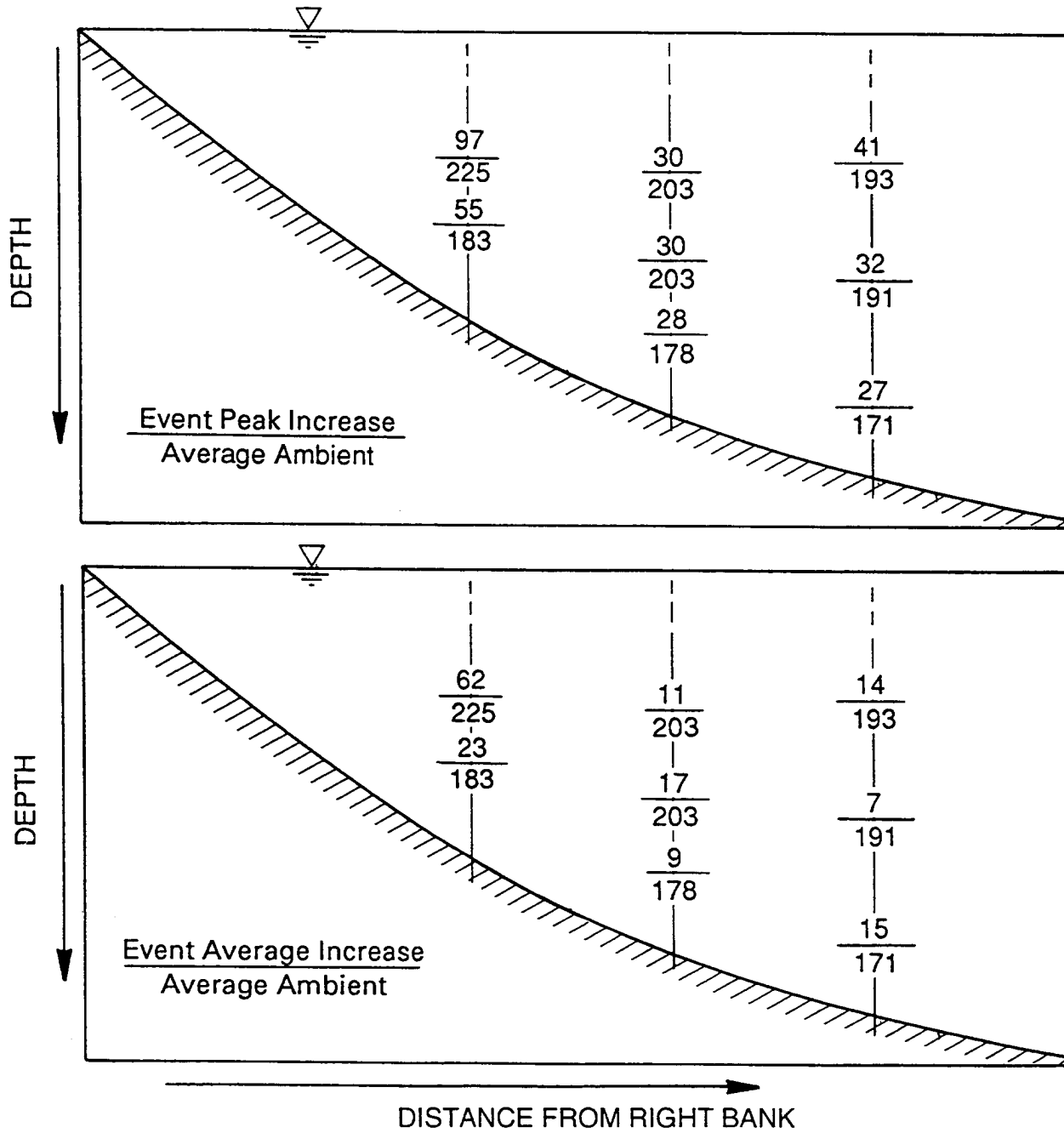




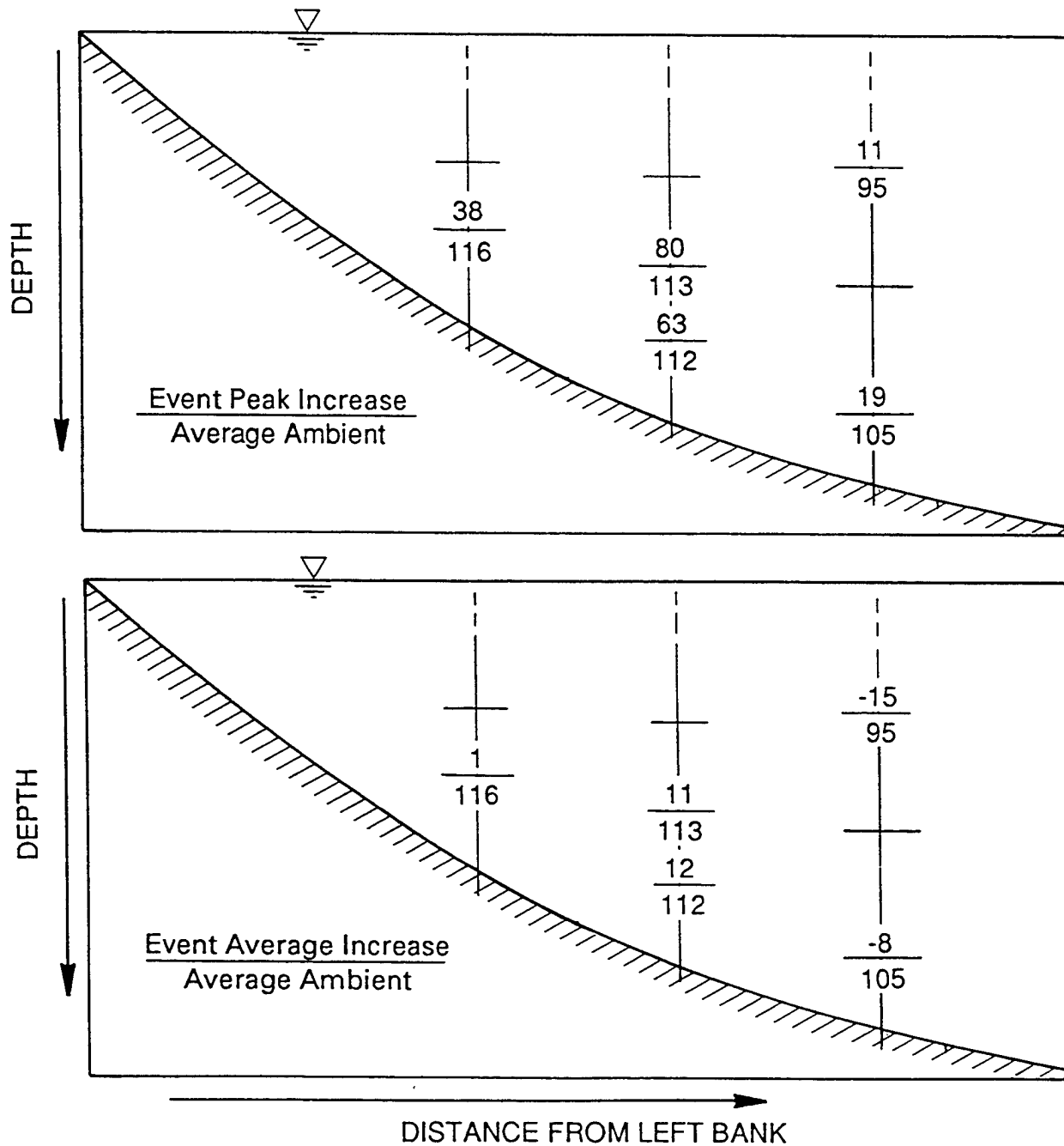
Mississippi River, mile 546.7, May 1990
Average Suspended Sediment Concentrations, mg/L



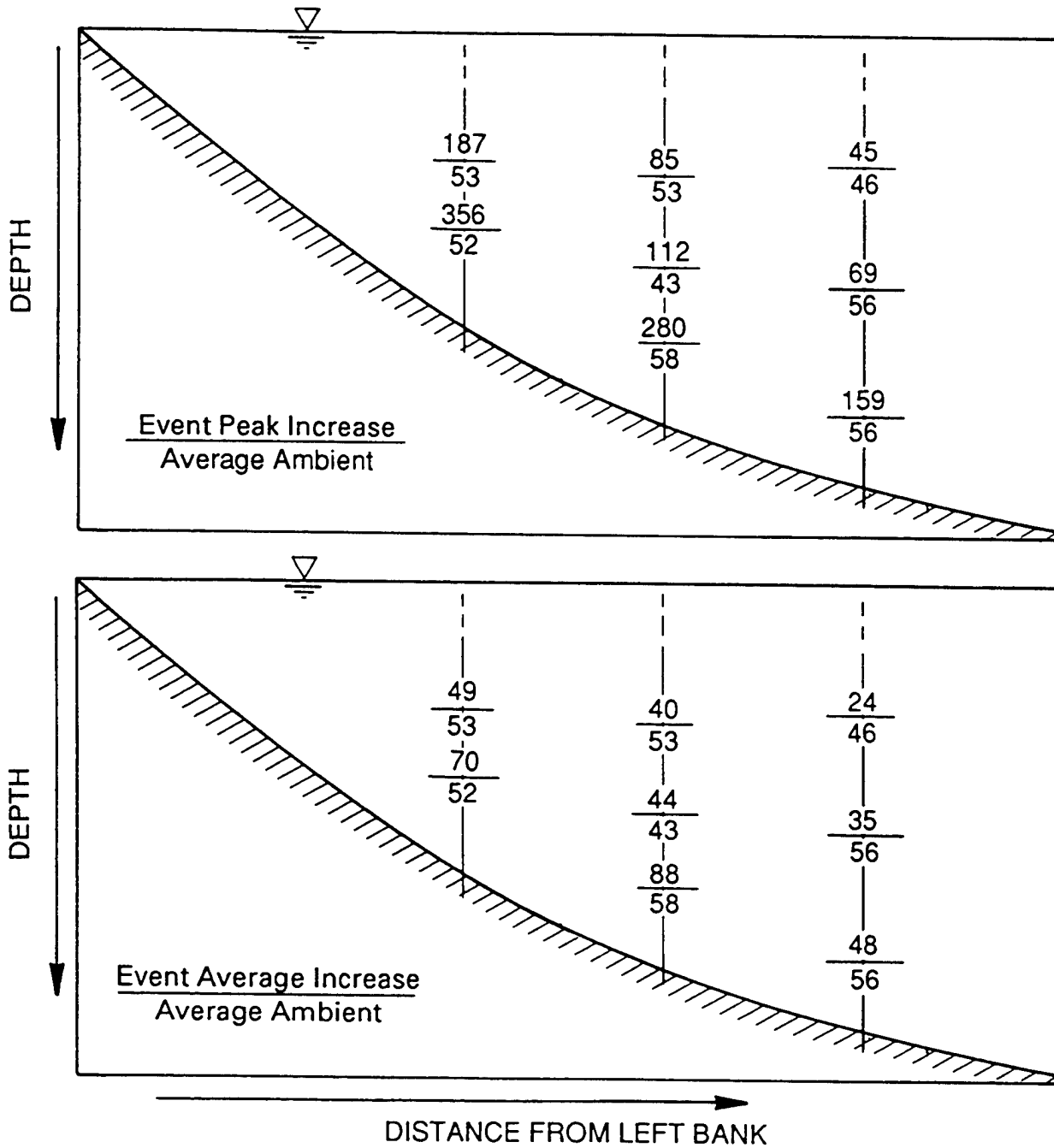
Mississippi River, mile 468.2, May 1992
Average Suspended Sediment Concentrations, mg/L



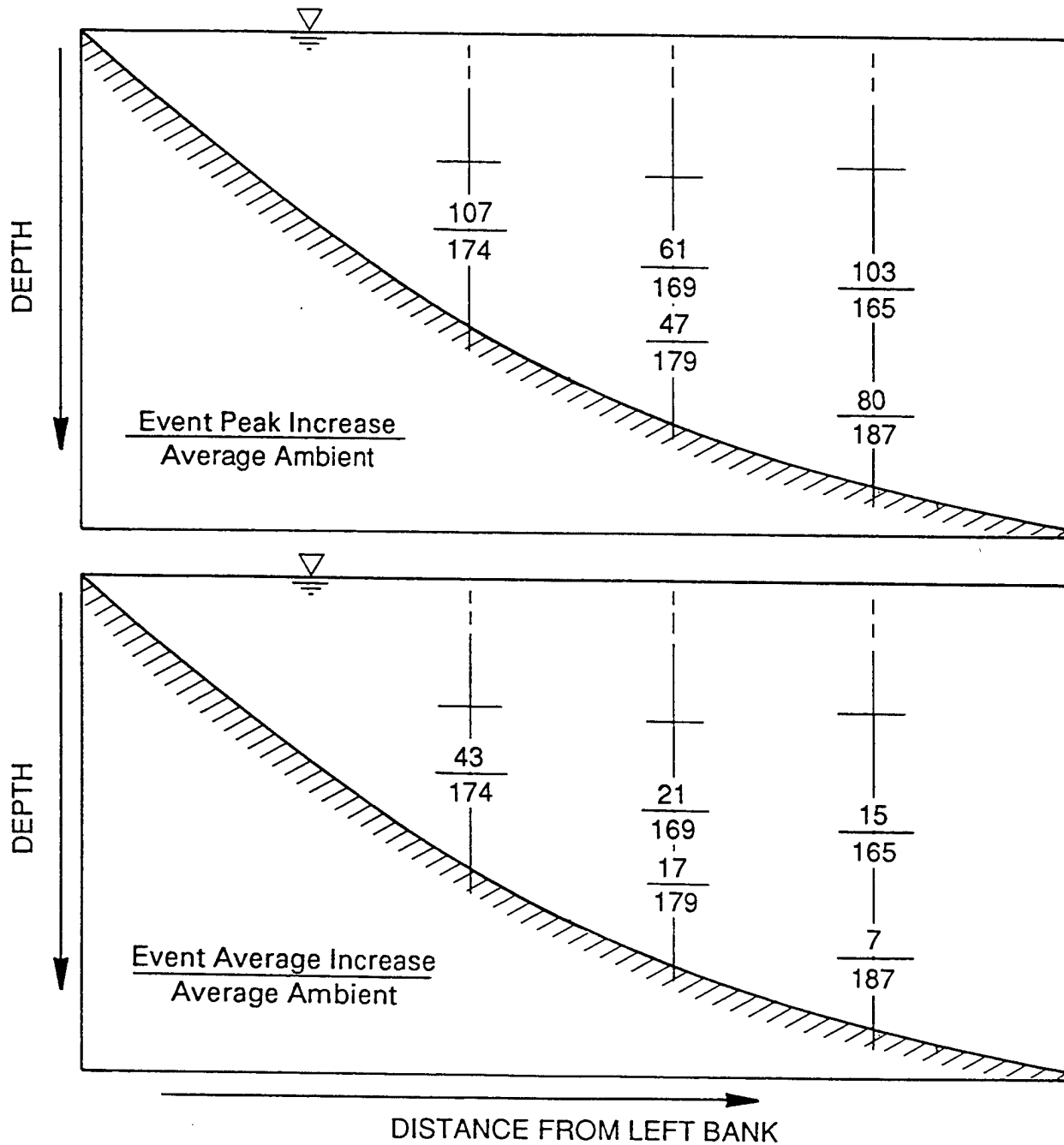
Mississippi River, mile 319.3, July 1991
Average Suspended Sediment Concentrations, mg/L



Illinois River, mile 50.1, May 1989
Average Suspended Sediment Concentrations, mg/L



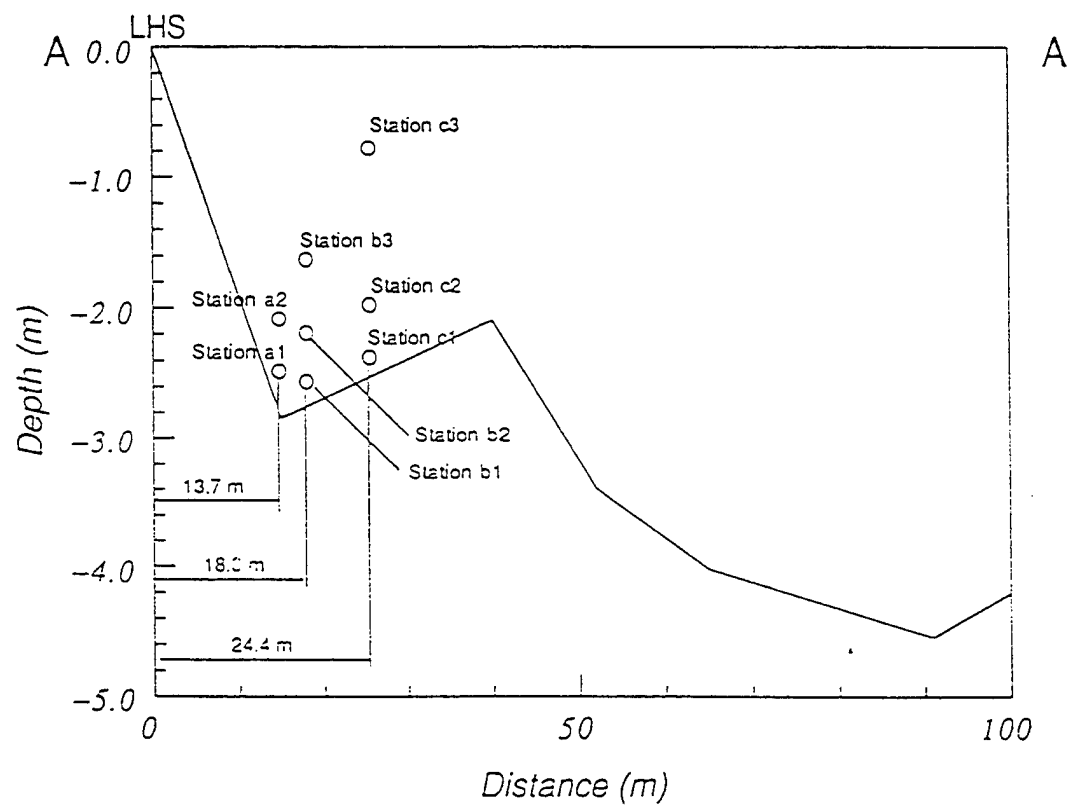
Mississippi River, mile 319.3, August 1990
Average Suspended Sediment Concentrations, mg/L

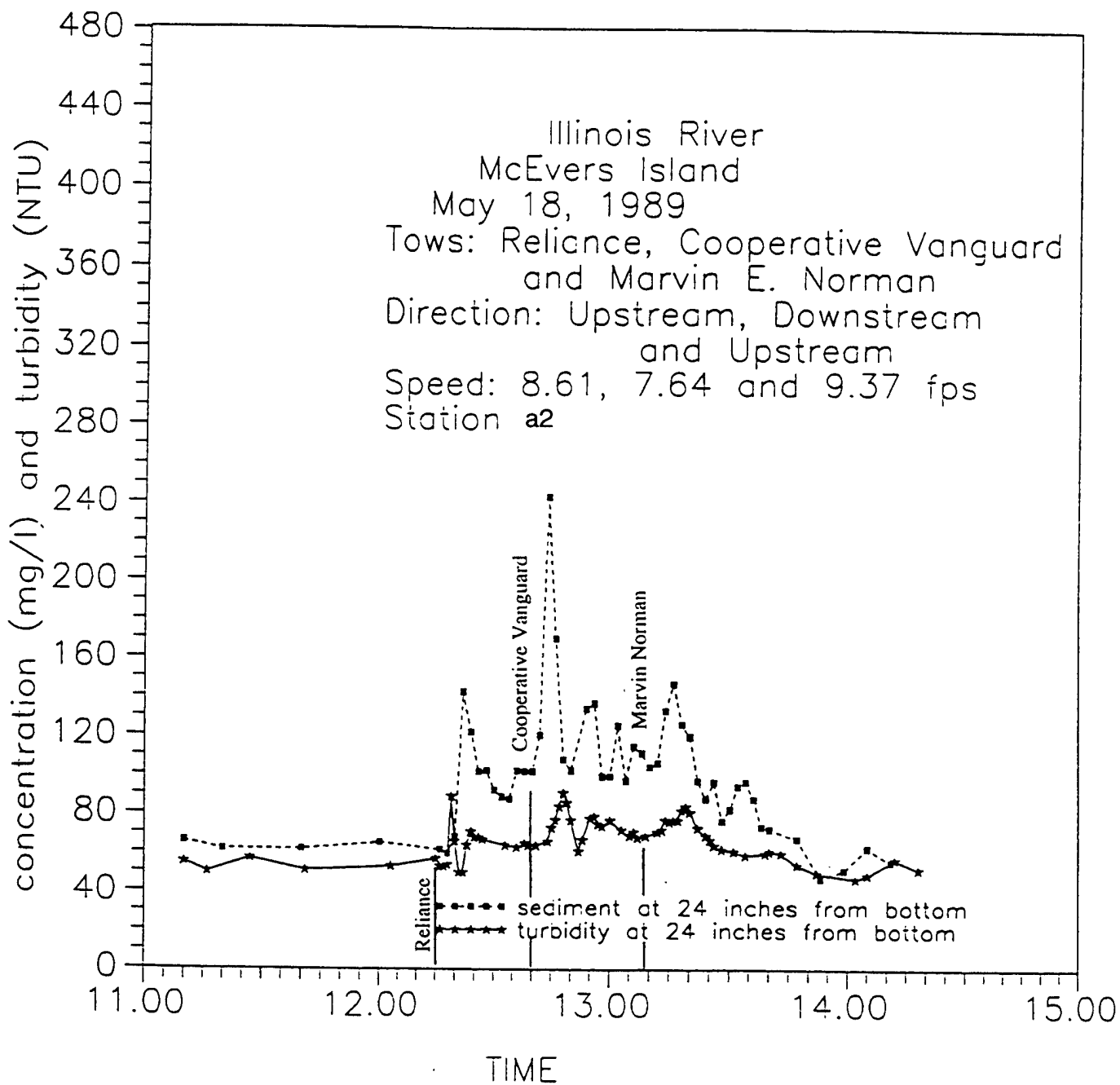


APPENDIX XXVIII.

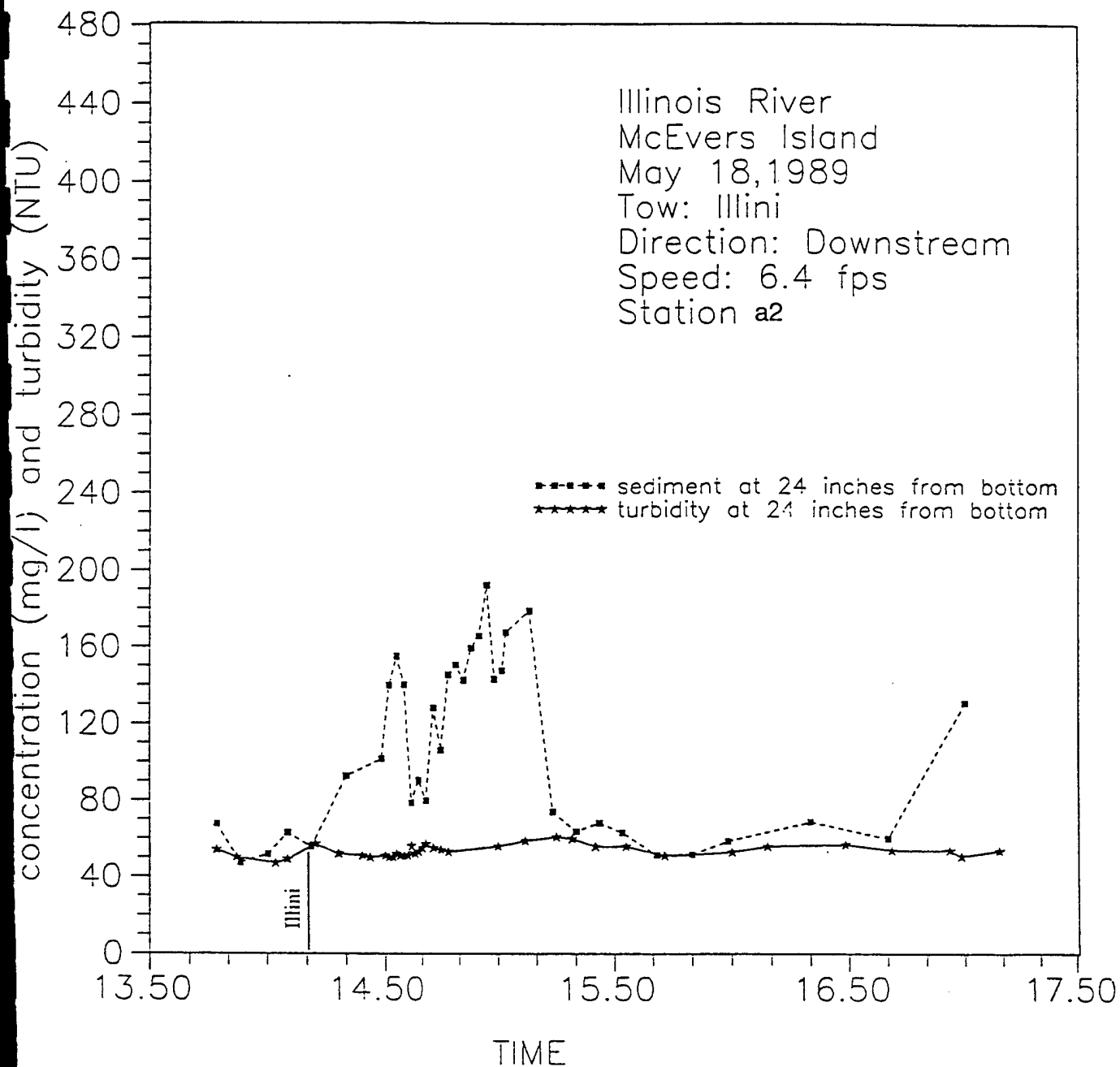
**COMPARISON OF TURBIDITY AND SUSPENDED SEDIMENT CONCENTRATION
AT MCEVER'S ISLAND**

Location of suspended sediment sampling stations
on the Illinois River near the McEver's Island site

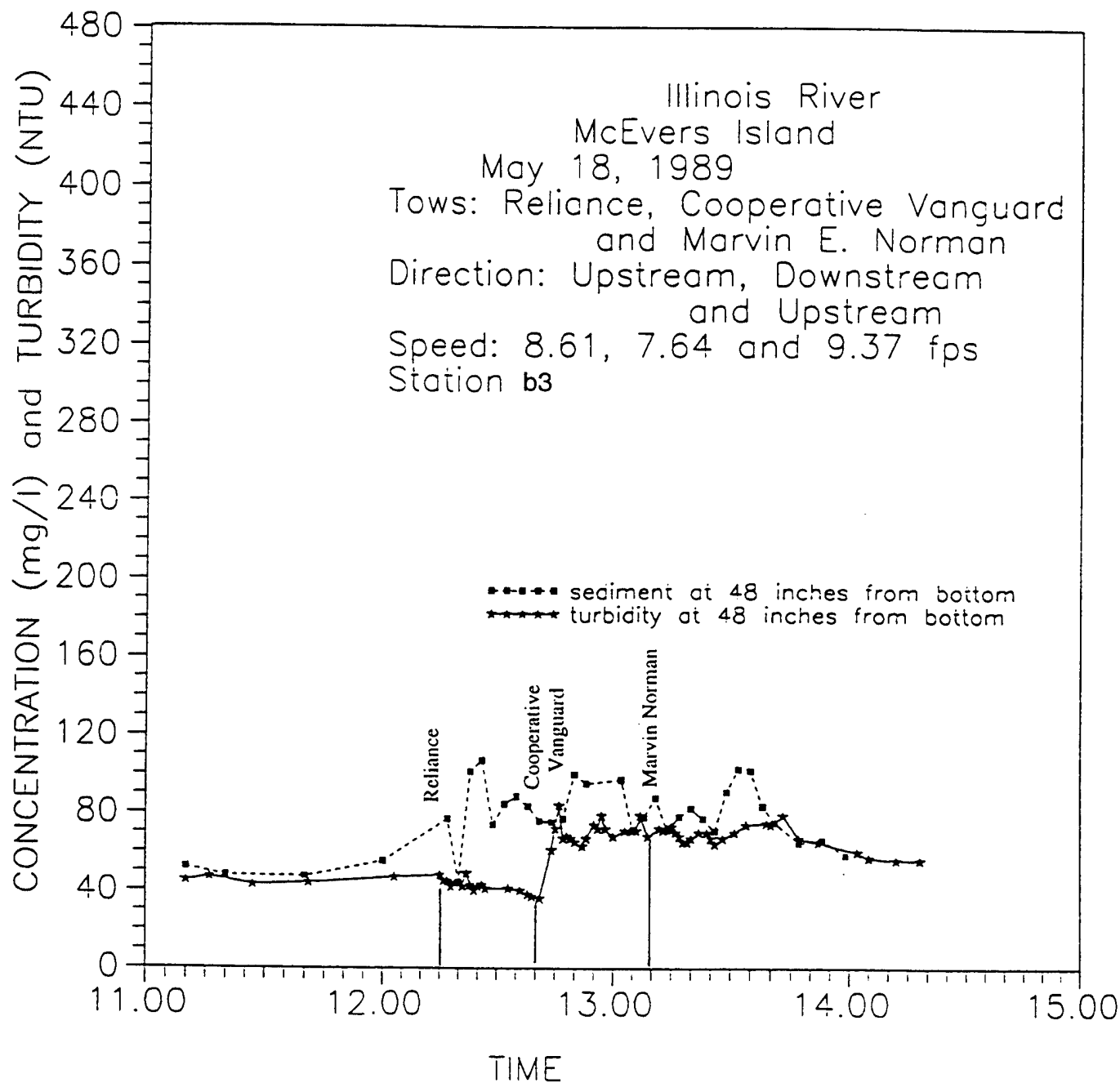




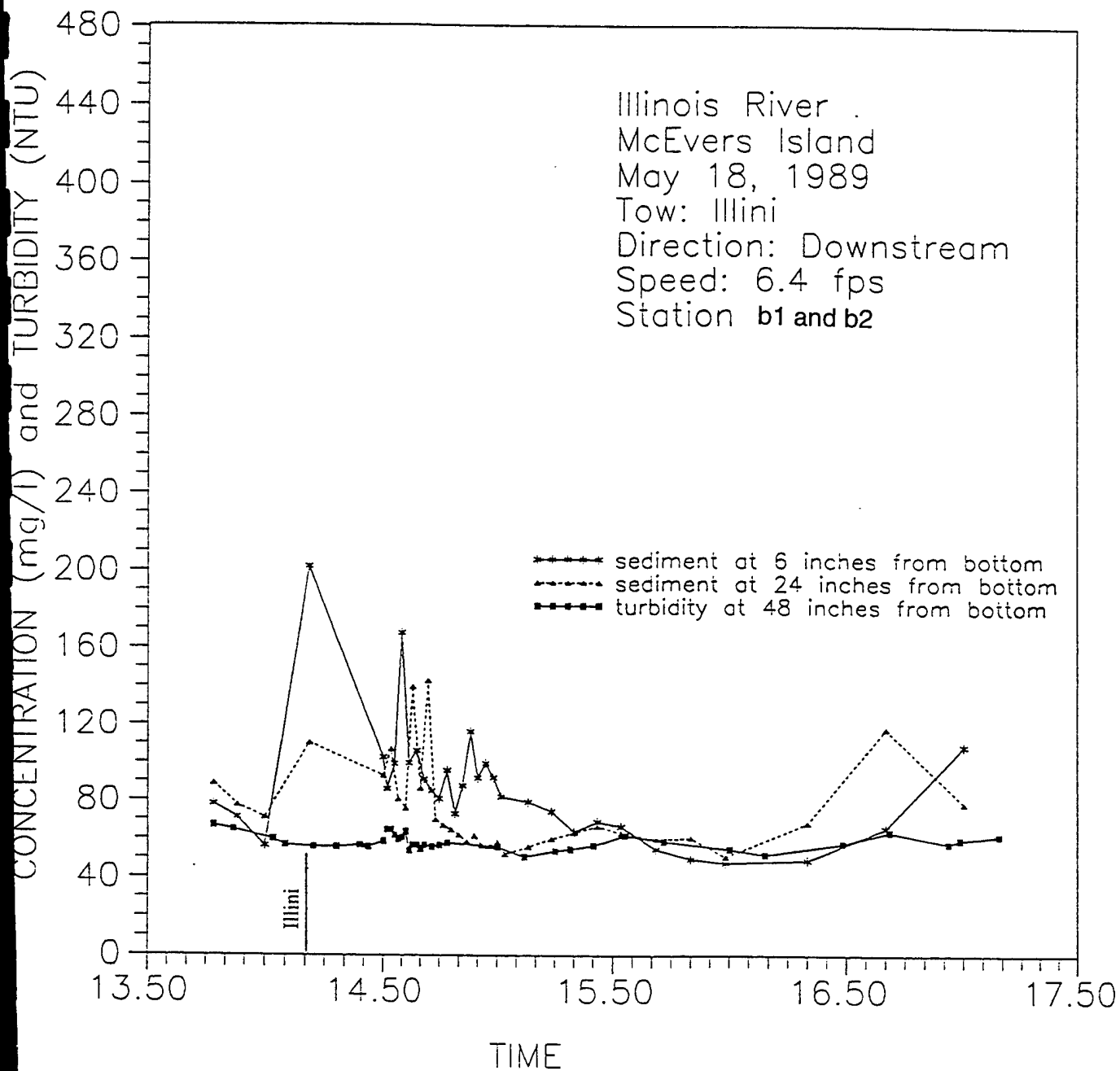
XXVIII-1. Comparison of turbidity and suspended sediment concentration
at station a2, 11:00 a.m. to 3:00 p.m., May 18, 1989



XXVIII-2. Comparison of turbidity and suspended sediment concentration
at station a2, 1:50 p.m. to 5:50 p.m., May 18, 1989



XXVIII-3. Comparison of turbidity and suspended sediment concentration
at station b3, 11:00 a.m. to 3:00 p.m., May 18, 1989



XXVIII-4. Comparison of turbidity and suspended sediment concentration
at station b1 and b2, 1:50 p.m. to 5:50 p.m., May 18, 1989

APPENDIX XXIX.

SUSPENDED SEDIMENT PARTICLE SIZE DISTRIBUTION

**List of Suspended Sediment Particles Analyzed,
Goose Island, Trip 1**

<i>Date</i>	<i>Time</i>	<i>Intake station</i>	<i>Dry weight, g</i>	<i>Lab No.</i>
08/24/90	12:42 - 12:53	a1	1.9958	379
	12:42 - 12:53	b1	1.9637	380
	12:42 - 12:53	b2	2.0393	381
	12:42 - 12:53	c1	1.8865	382
	12:42 - 12:53	c2	2.0263	383
08/25/90	10:21 - 10:34	a1	2.1207	384
	10:21 - 10:38	b1	1.7704	385
	10:21 - 10:32	c1	2.1242	386
	15:29 - 15:43	a1	1.2947	387
	15:29 - 15:39	b1	1.2450	388
	15:29 - 15:39	c1	1.6579	389
08/26/90	09:48-09:58	a1	1.9601	390
	09:48-10:03	b1	1.3911	391
	09:48-10:03	c1	1.7110	392
08/27/90	11:56-12:05	a1	1.7031	395
	11:53-12:04	b1	2.5421	396
	11:55-12:06	c1	1.88051	397

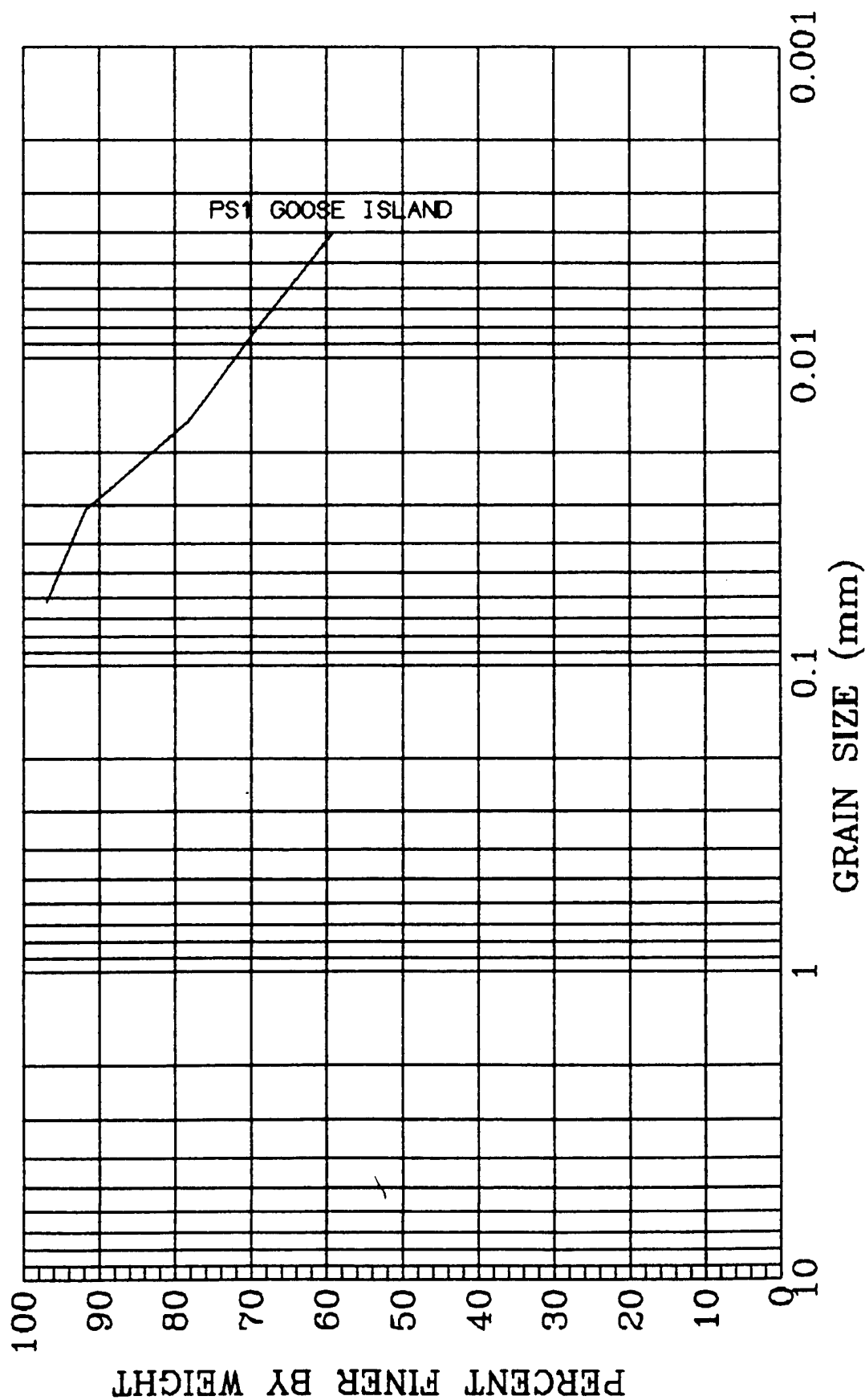
(During Barge-Tow Passage)

<i>Date</i>	<i>Time</i>	<i>Barge</i>	<i>Intake station</i>	<i>Dry weight, g</i>	<i>Lab No.</i>
08/26/90	11:44 - 11:56	K. Michael	a1	1.1636	393
	13:26 - 13:35	Sumac	b1	0.6856	394

ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

LAB. NO. 379

SAMPLE ID: GOOSE ISLAND
DATE: 08/90
TIME: 1242-1253
STATION: 1A 9 FROM BOTTOM
PROJECT: NAVIGATION IMPACT
COMMENTS:



ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

SAMPLE ID: GOOSE ISLAND

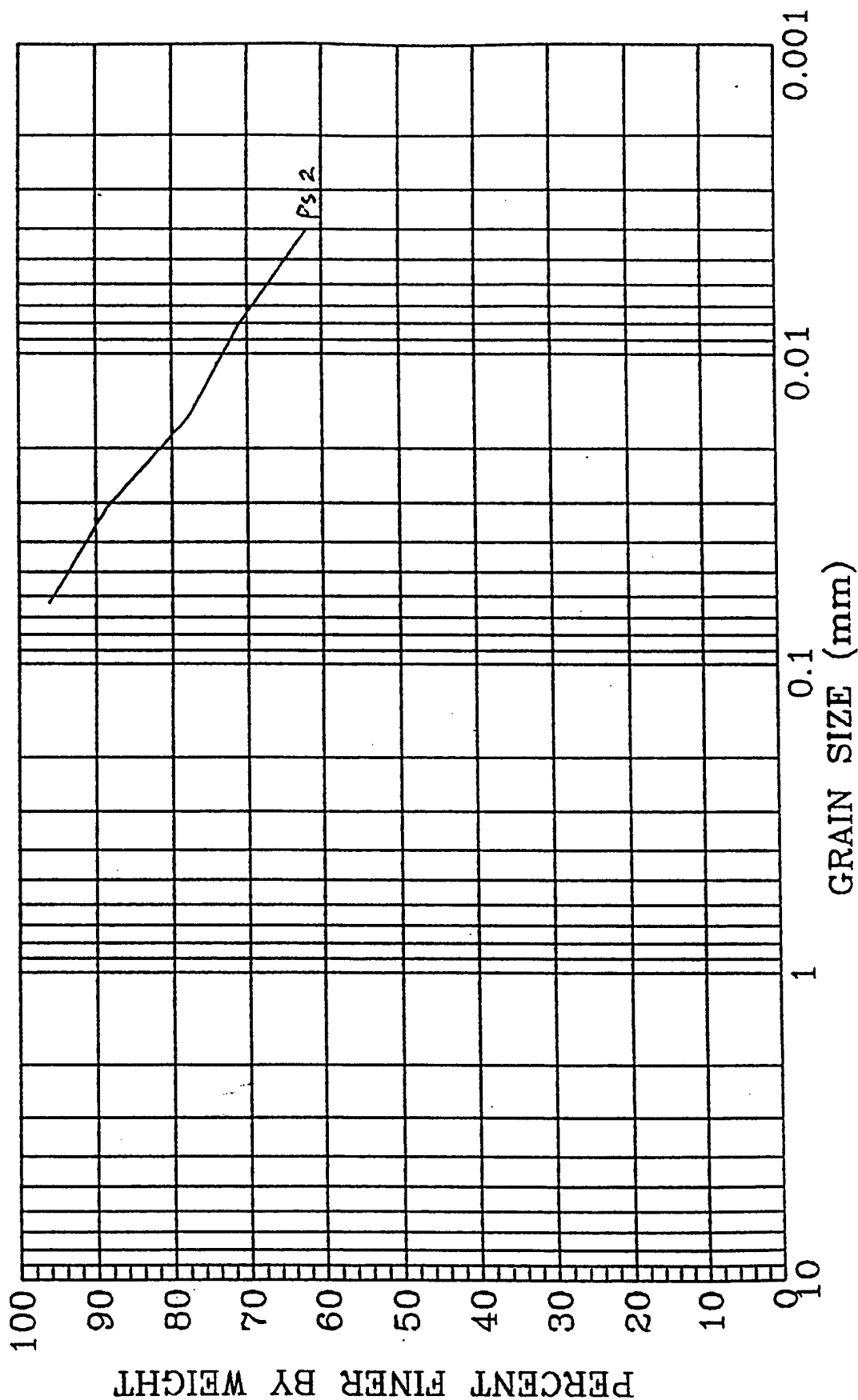
DATE: 08/90

TIME: 1242-1253

STATION: 2A 9 FROME BOTTOM

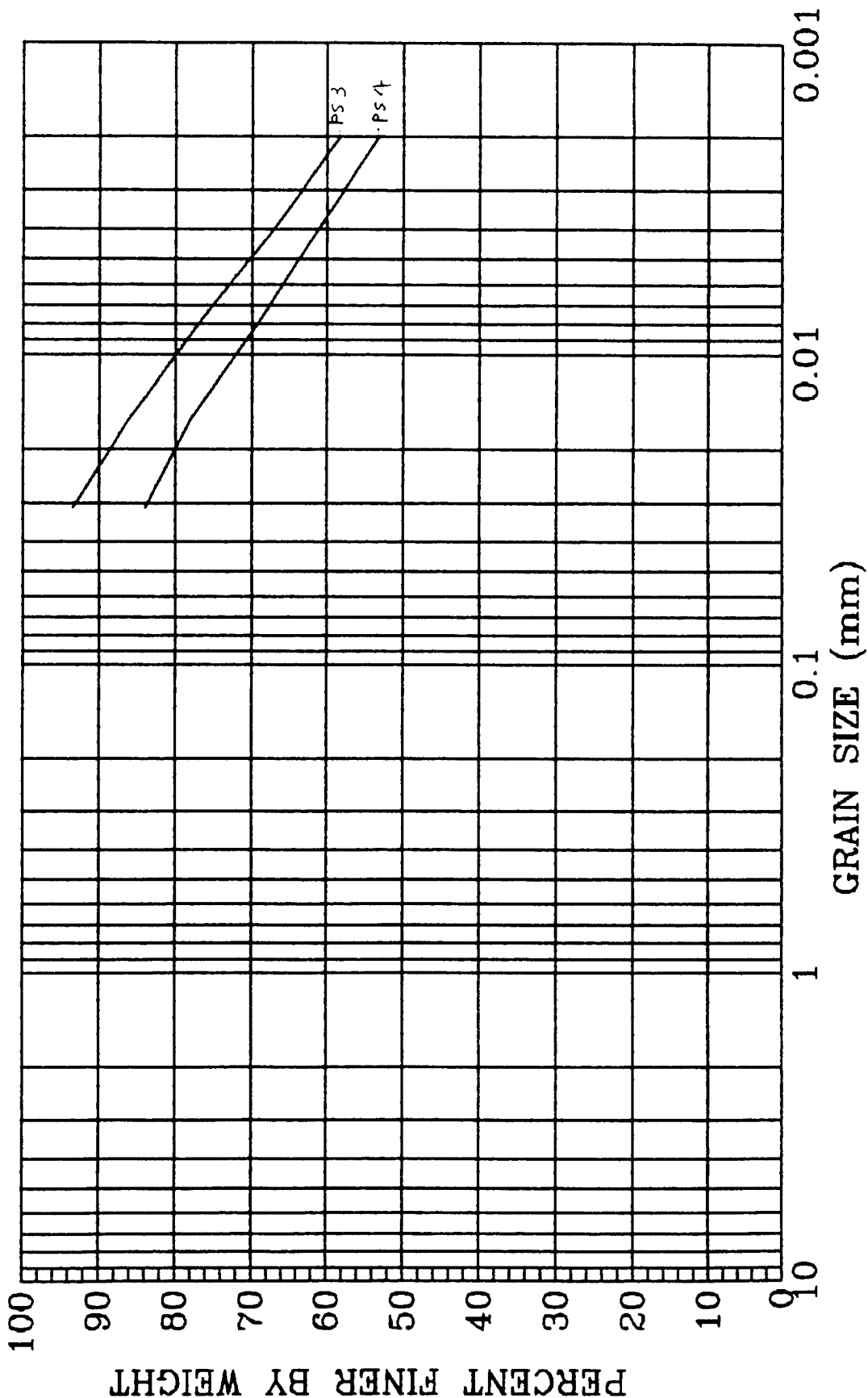
PROJECT: NAVIGATION IMPACT

COMMENTS:



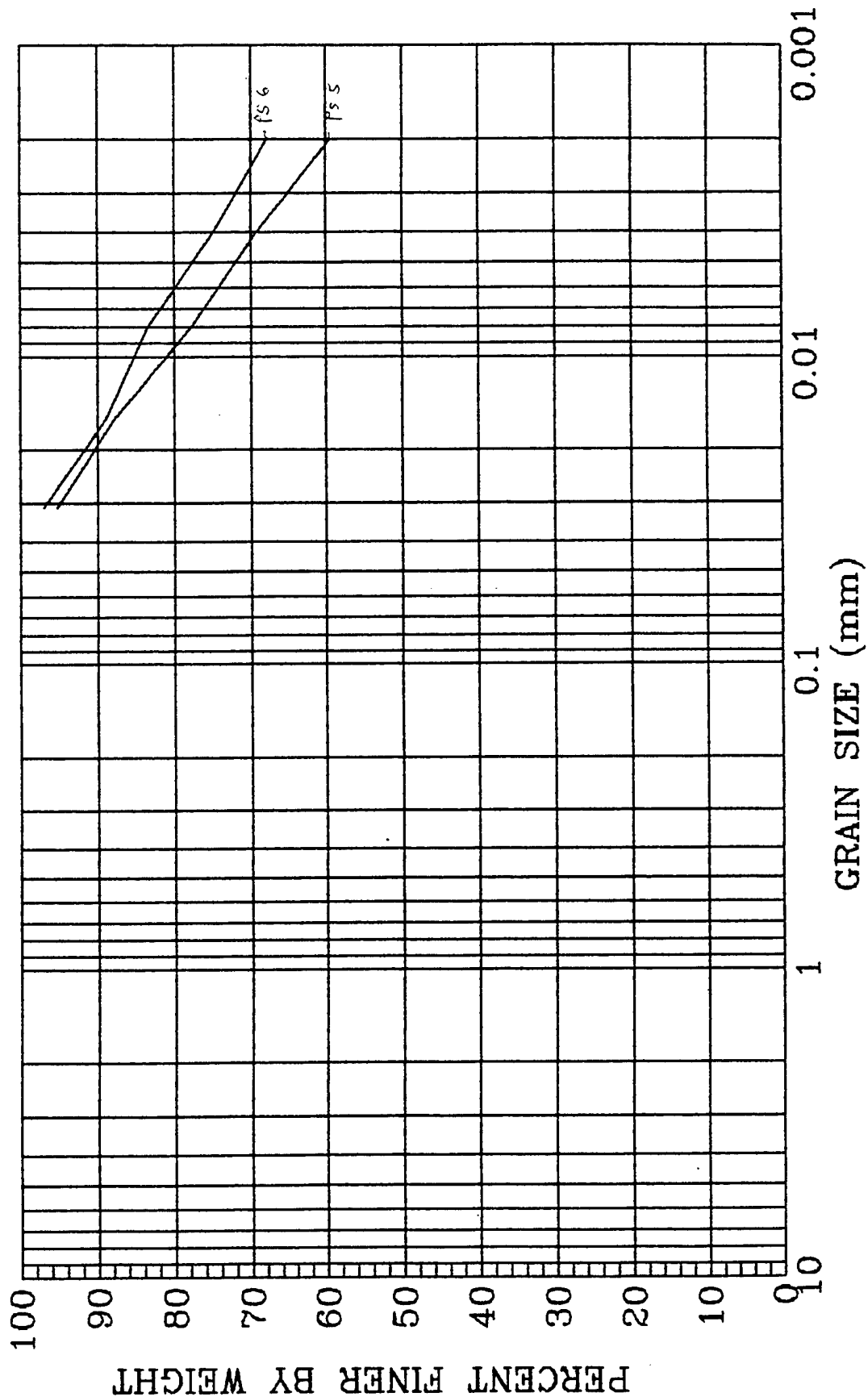
ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: NAVIGATION IMPACT
ANALYSIS DATE: 04/29/94
COLLECTED DATE: 08/24/90
TIME: PS3(1242-1251) PS4(1240-1254)
SITE: GOOSE ISLAND
COMMENTS:



ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

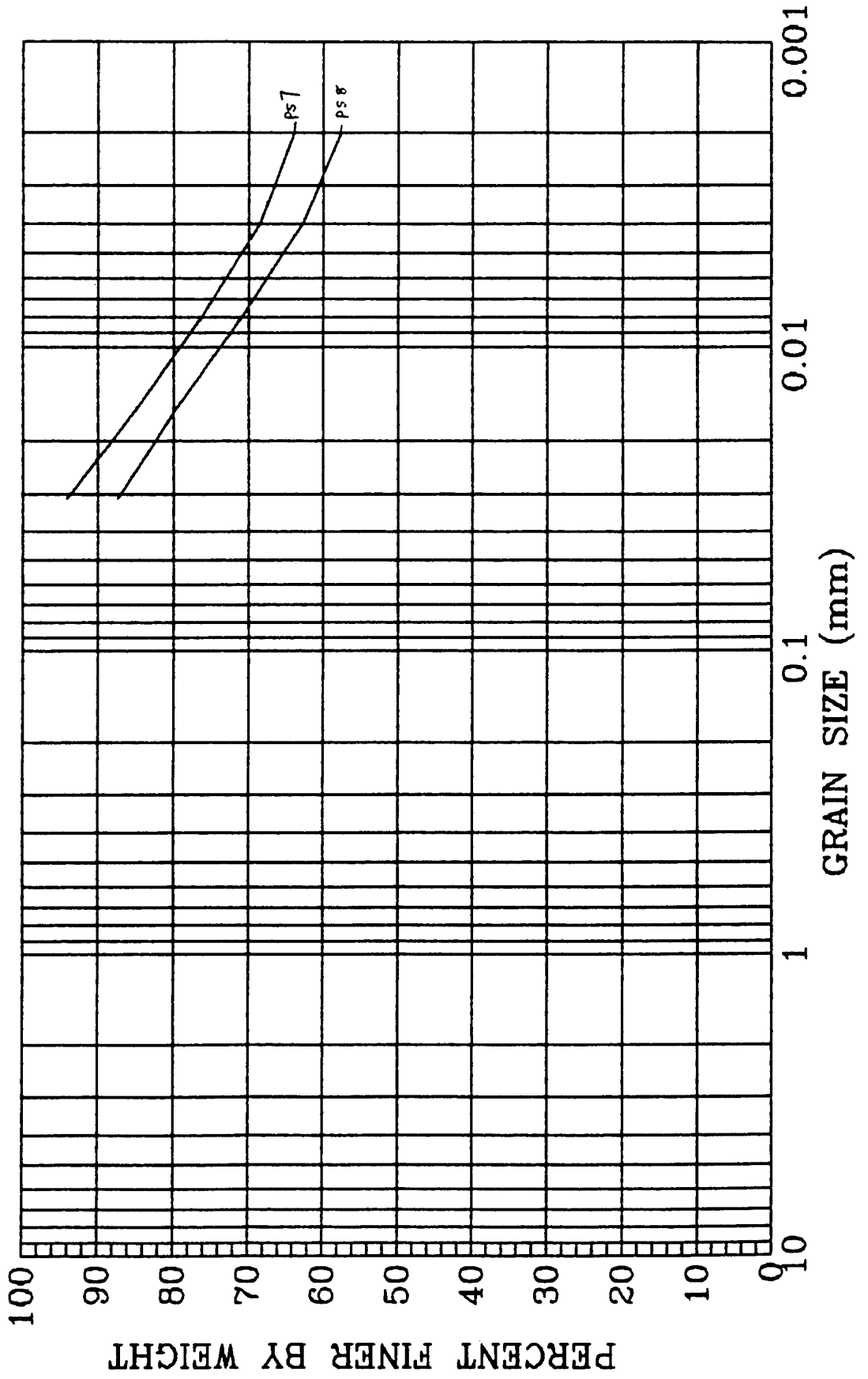
PROJECT: navigation impact
ANALYSIS DATE: 04/29/94
COLLECTED DATE: 08/24/90
TIME: ps5(1240-1253) ps6(1021-1034)
SITE: goose island
COMMENTS:



LAB. NO. 385
LAB. NO. 386

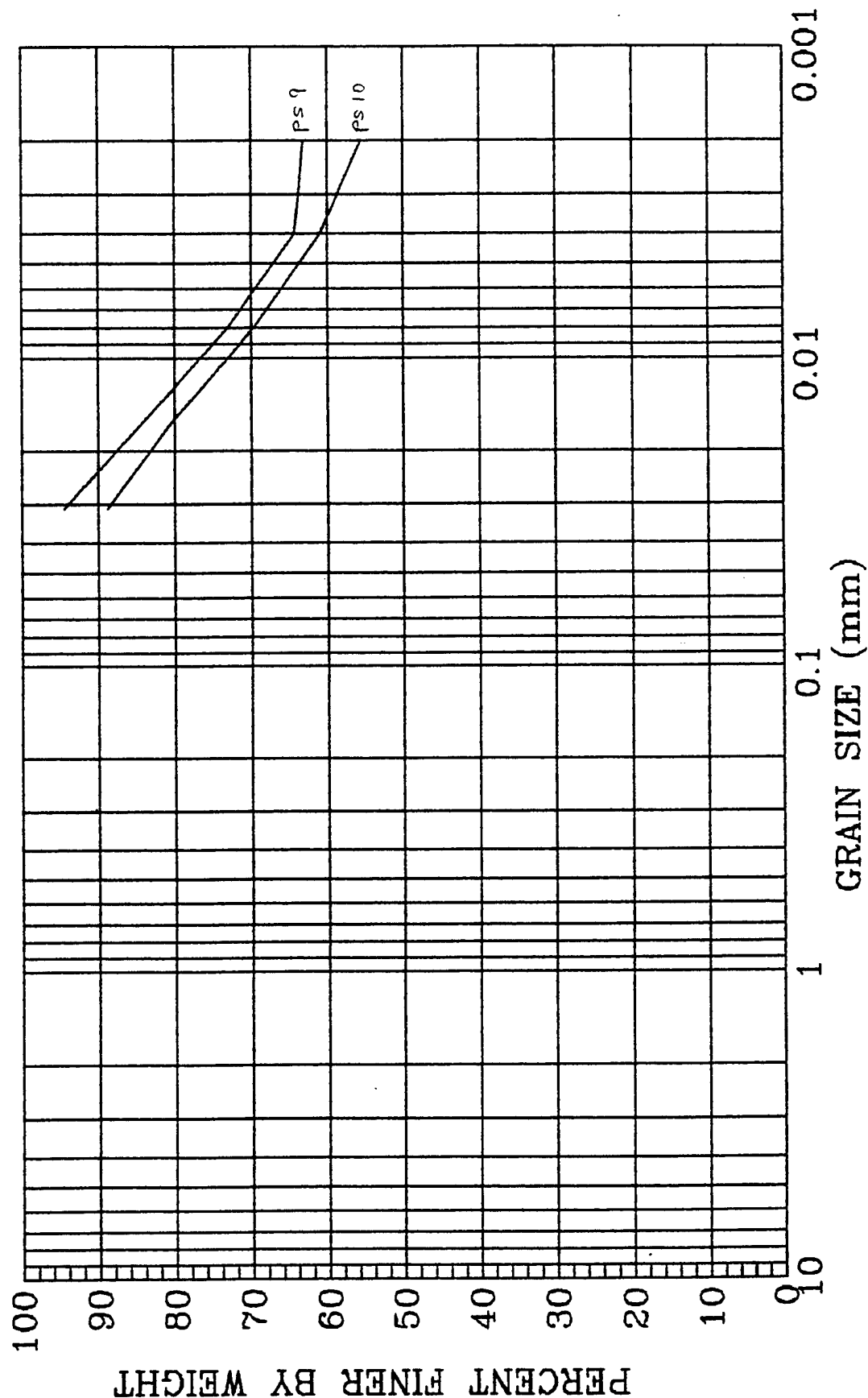
ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 04/29/94
COLLECTED DATE: 08/24/90
TIME: ps7(1021-1036) ps8(1021-1032)
SITE: goose island
COMMENTS:



ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

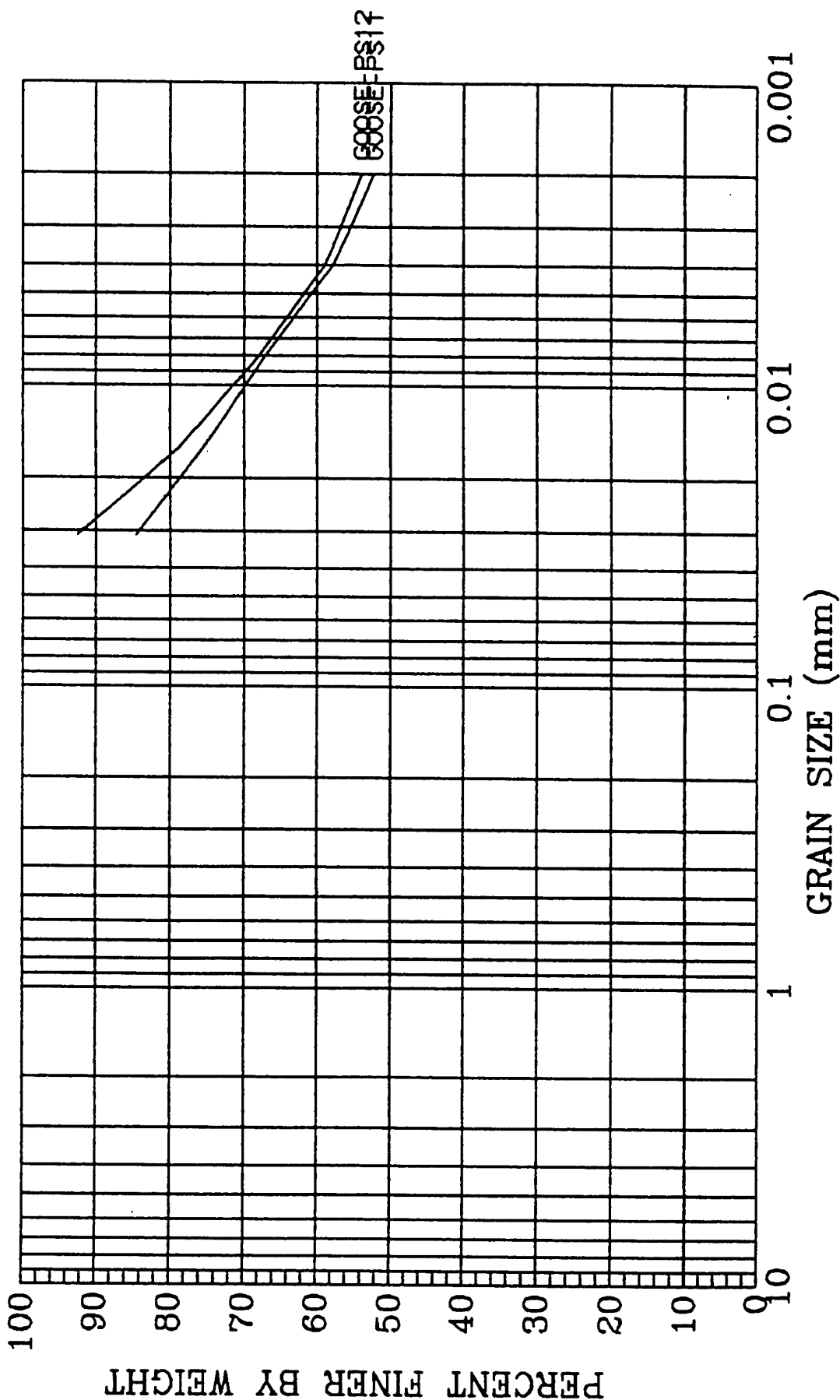
PROJECT: navigation impact
ANALYSIS DATE: 04/94
COLLECTED DATE: 08/25/90
TIME: ps9(1529-1539) PS10(1529-1543)
SITE: goose island
COMMENTS:



LAB. NO. 389
LAB. NO. 390

ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 04/94
COLLECTED DATE: 08/25/90
TIME: ps11(1529-1539) ps12(948-958)
SITE: goose island
COMMENTS:



ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: navigation impact

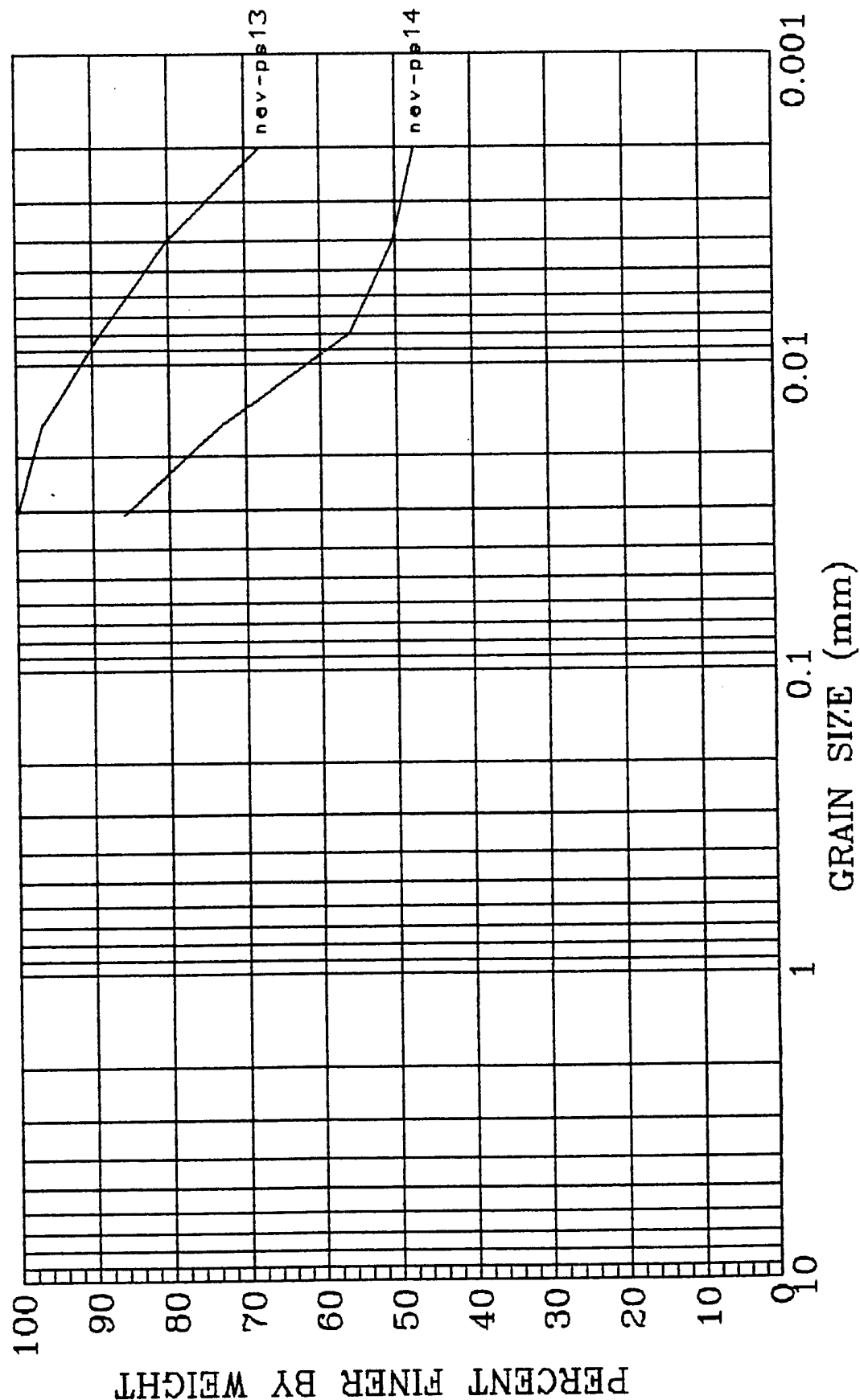
ANALYSIS DATE: 08/31/94

COLLECTED DATE: 08/28/90

TIME: ps13(948-1003) ps14(948-1003)

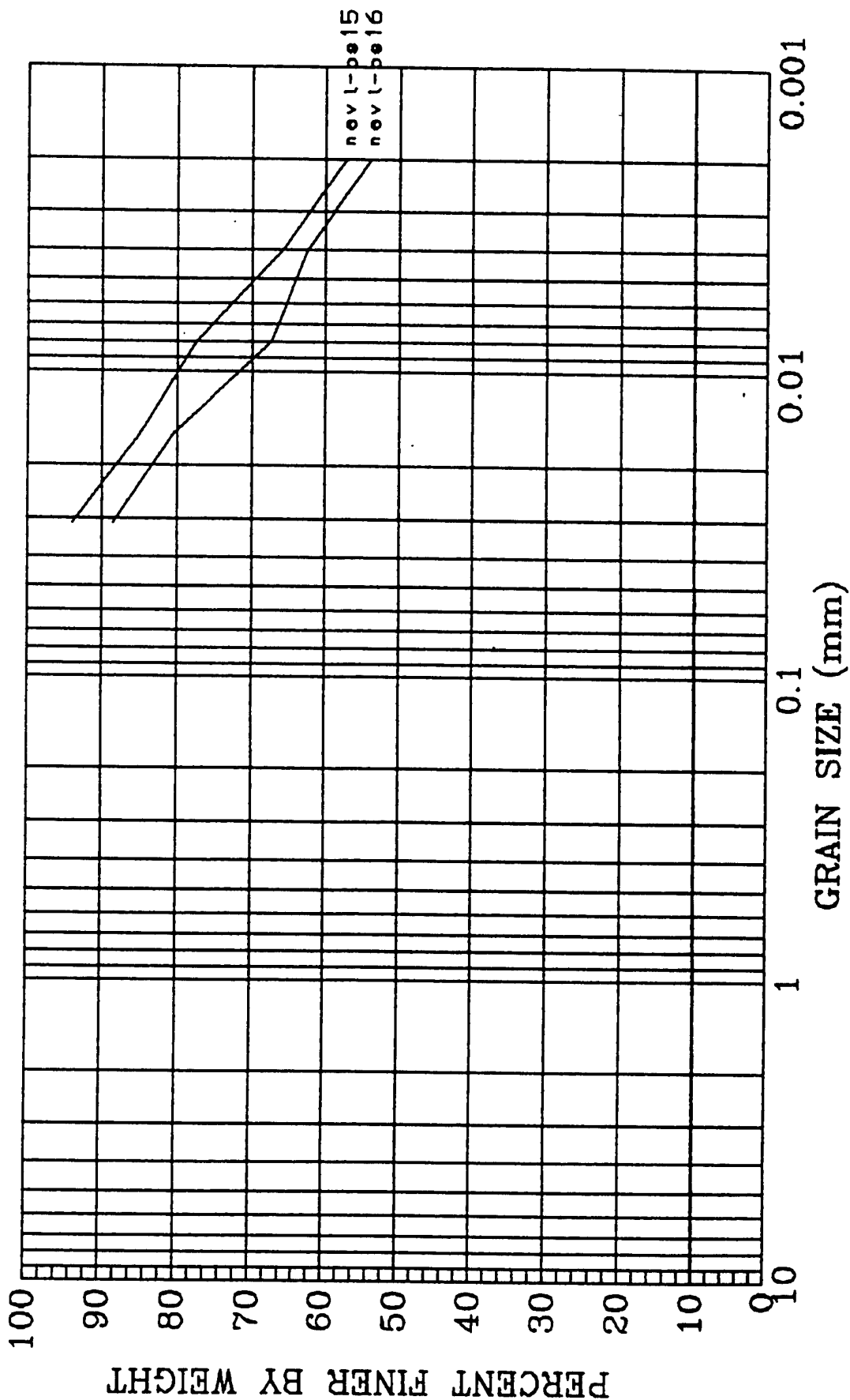
SITE: goose island

COMMENTS:



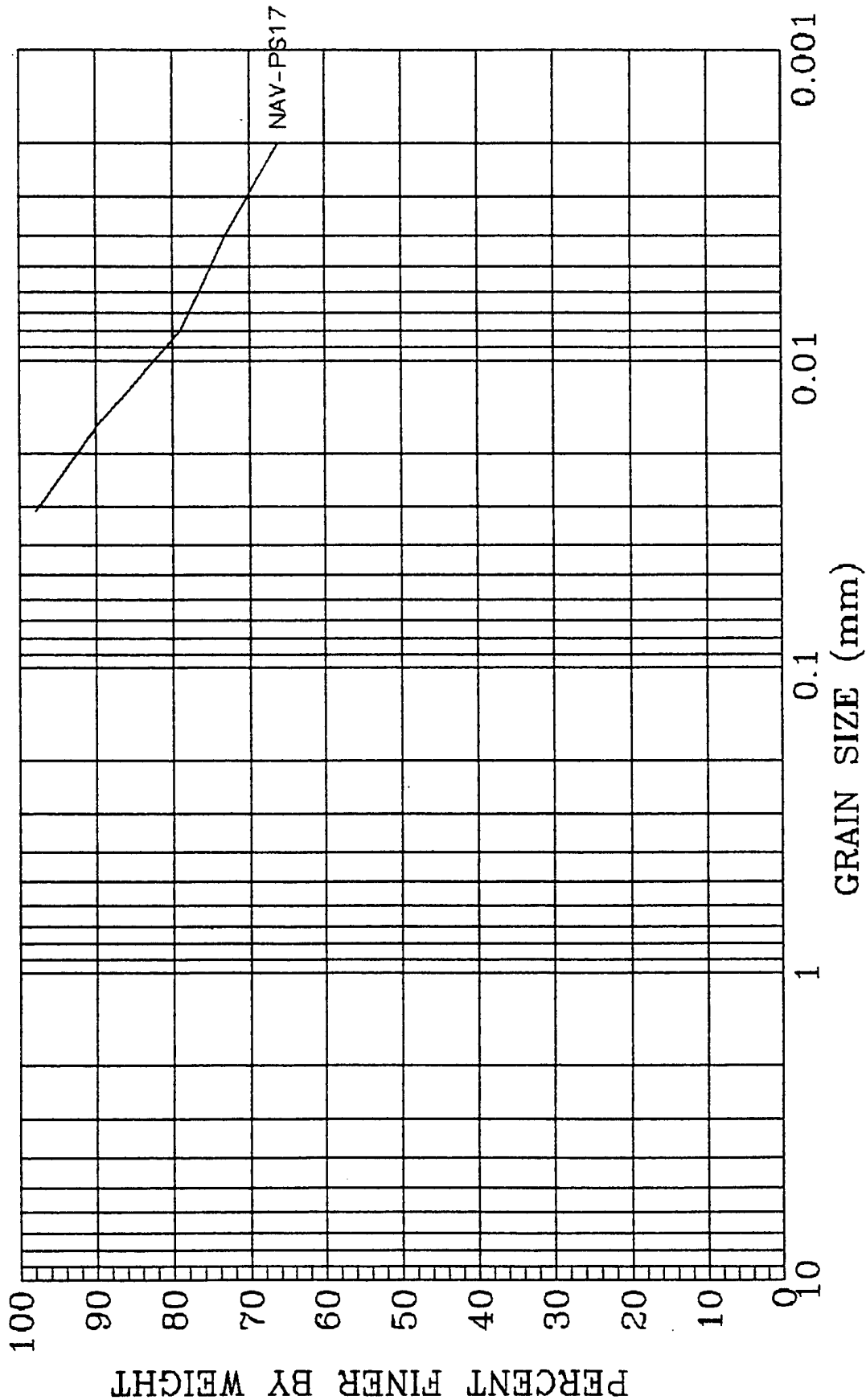
ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

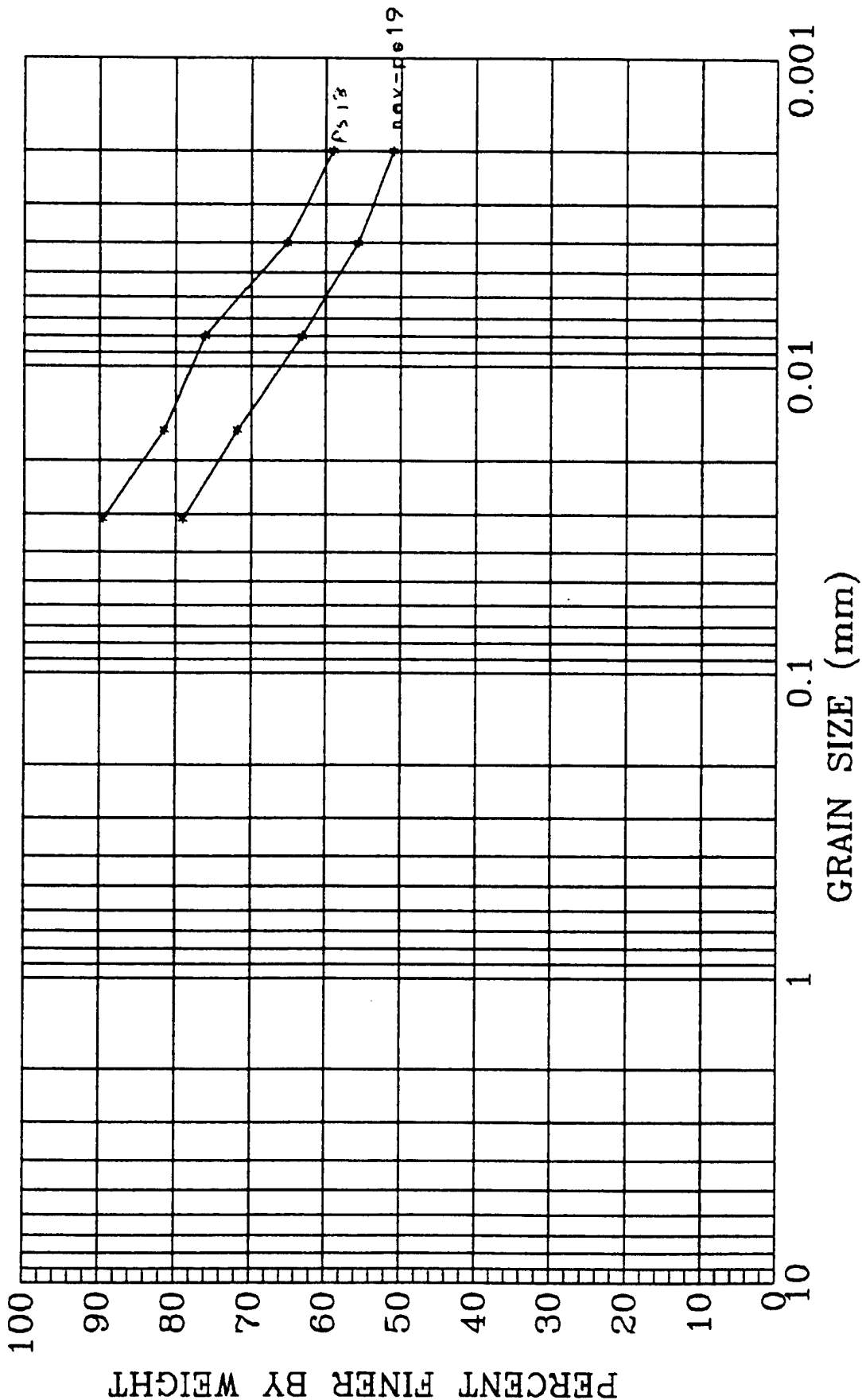
PROJECT: navigation impact
ANALYSIS DATE: 08/31/94
COLLECTED DATE: 08/26/90
TIME: ps15(1144-1156) ps16(1326-1335)
SITE: goose island
COMMENTS:



ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 09/28/94
COLLECTED DATE: 08/27/90
TIME: 1156-1205
SITE:goose island.background
COMMENTS:1 A 9"from bottom





**List of Suspended Sediment Particles Analyzed,
Goose Island, Trip 2**

<i>Date</i>	<i>Time</i>	<i>Intake station</i>	<i>Dry weight, g</i>	<i>Lab No.</i>
07/22/91	14:38 - 14:45	d2	0.9599	408
	15:00 - 1509	b1	0.8878	403
	15:00 - 1507	b2	0.8878	404
	15:00 - 1509	e1	0.8180	411
	16:36 - 16:42	d1	0.9958	406
	16:37 - 16:42	d2	1.1943	409
	16:50 - 16:59	b1	1.1237	400
	16:50 - 16:57	b2	0.9955	401
	17:10 - ?	d1	0.833	414
07/23/91	11:31 - 11:39	b1	0.8299	399
	11:45 - ?	d1	0.7915	416
	11:45 - ?	d2	0.8089	410
	11:45 - ?	e1	0.8180	412

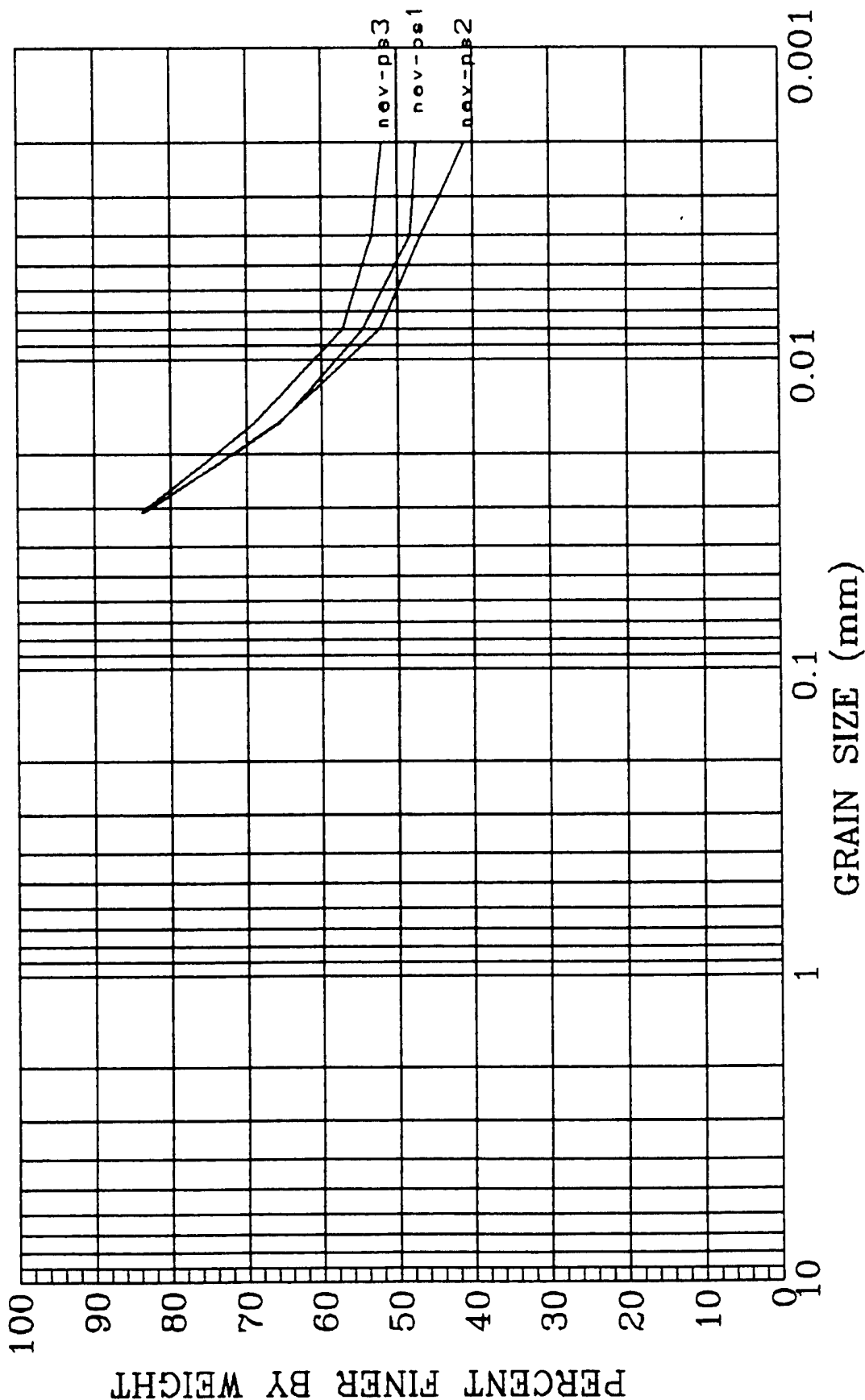
(During Barge-Tow Passage)

<i>Date</i>	<i>Time</i>	<i>Barge</i>	<i>Intake station</i>	<i>Dry weight, g</i>	<i>Lab No.</i>
07/23/91	16:25 - ?	Evey - T	b1	1.1077	398
	16:25 - ?		b2	1.2544	405
	16:30 - ?		d1	0.7705	417
	16:30 - ?		d2	1.0641	415
	16:30 - ?		e1	0.6456	413

LAB. NO. 398
LAB. NO. 399
LAB. NO. 400

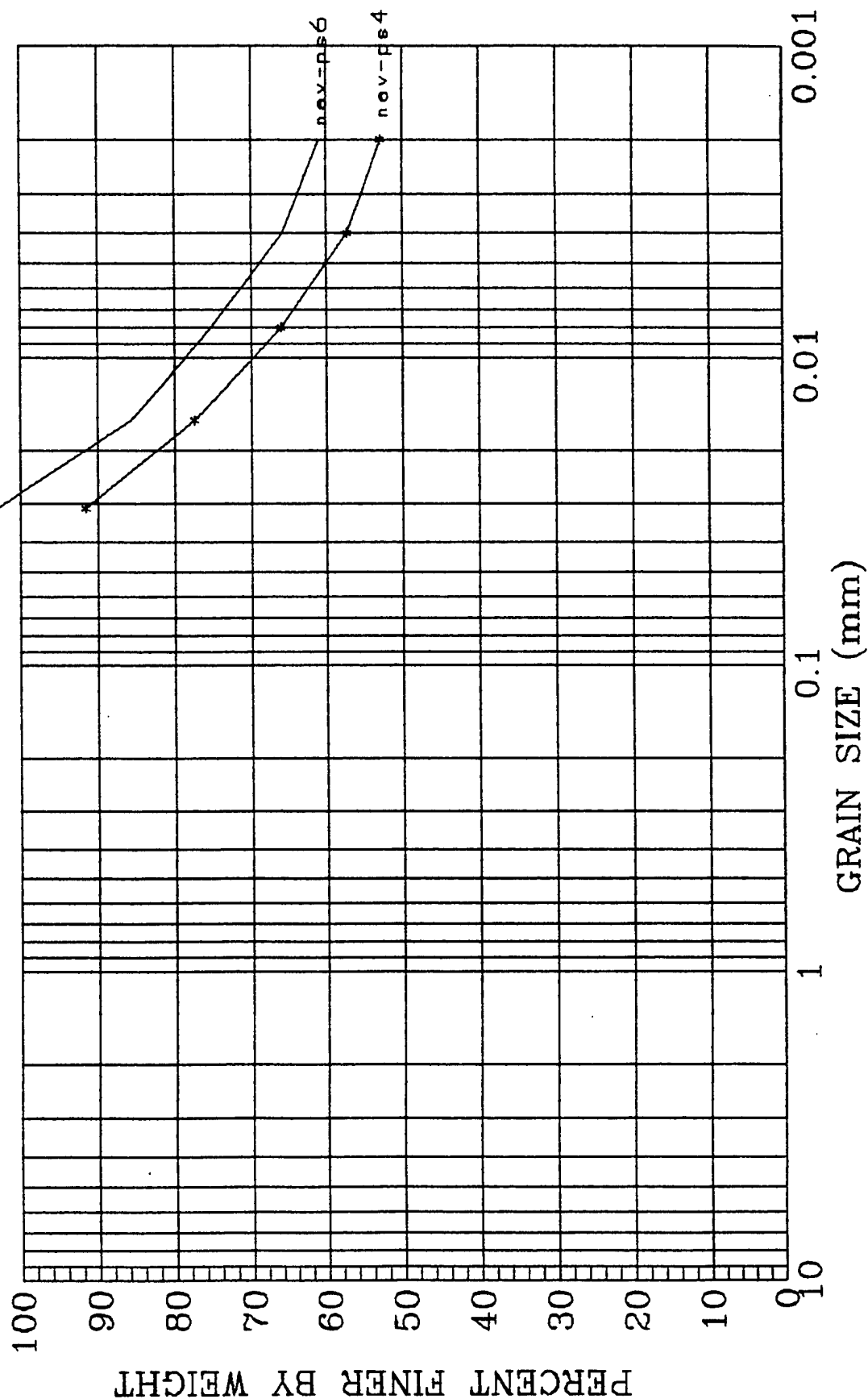
ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 07/23/91
TIME: ps1(1625)ps2(1131-1139)
SITE: goose island station 2A
COMMENTS: ps3(1650-1659)



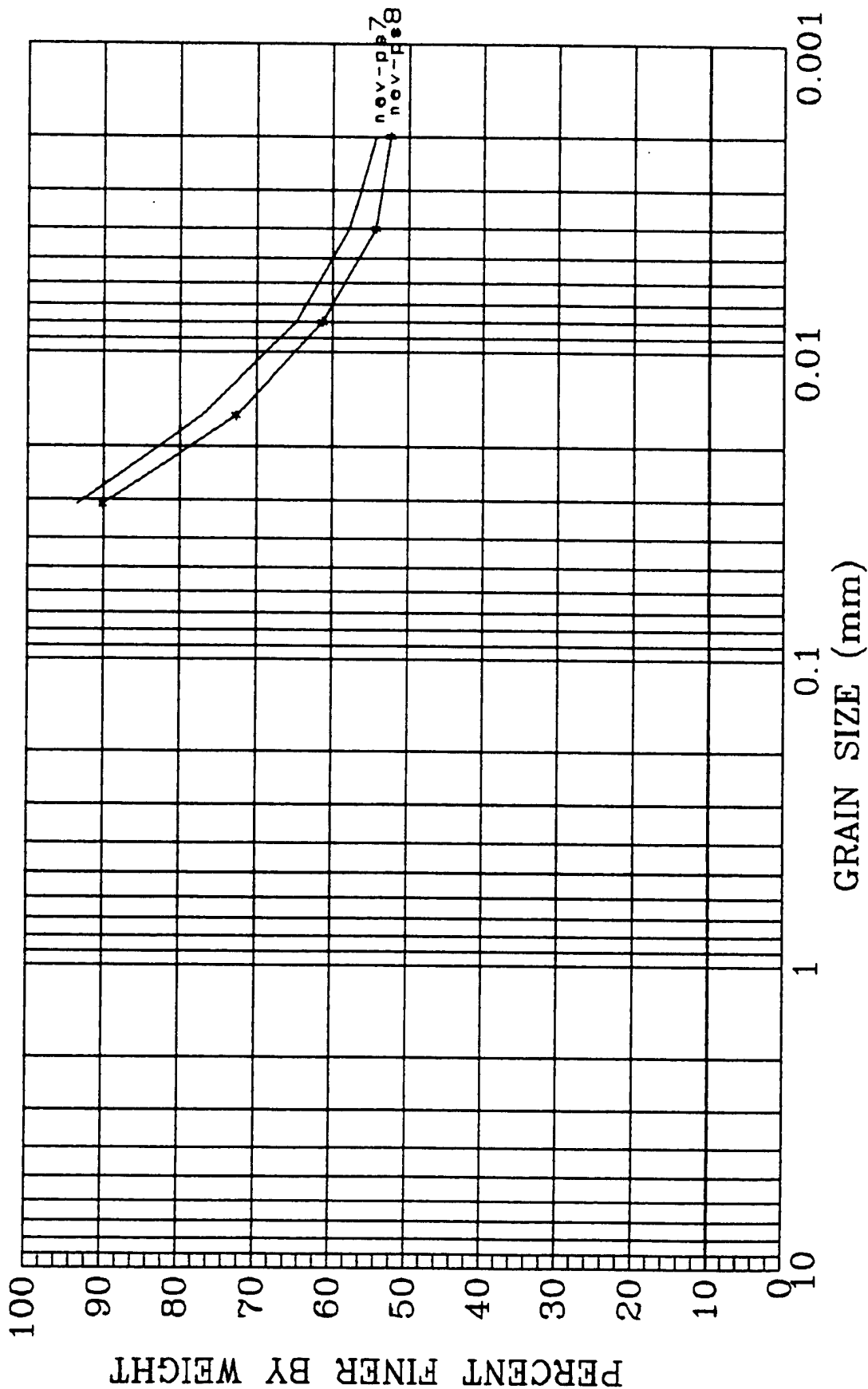
ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 07/22/91
TIME: ps4(1650-1657)ps6(1500-1509)
SITE: goose island
STATION: ps4(2B)ps6(2A)



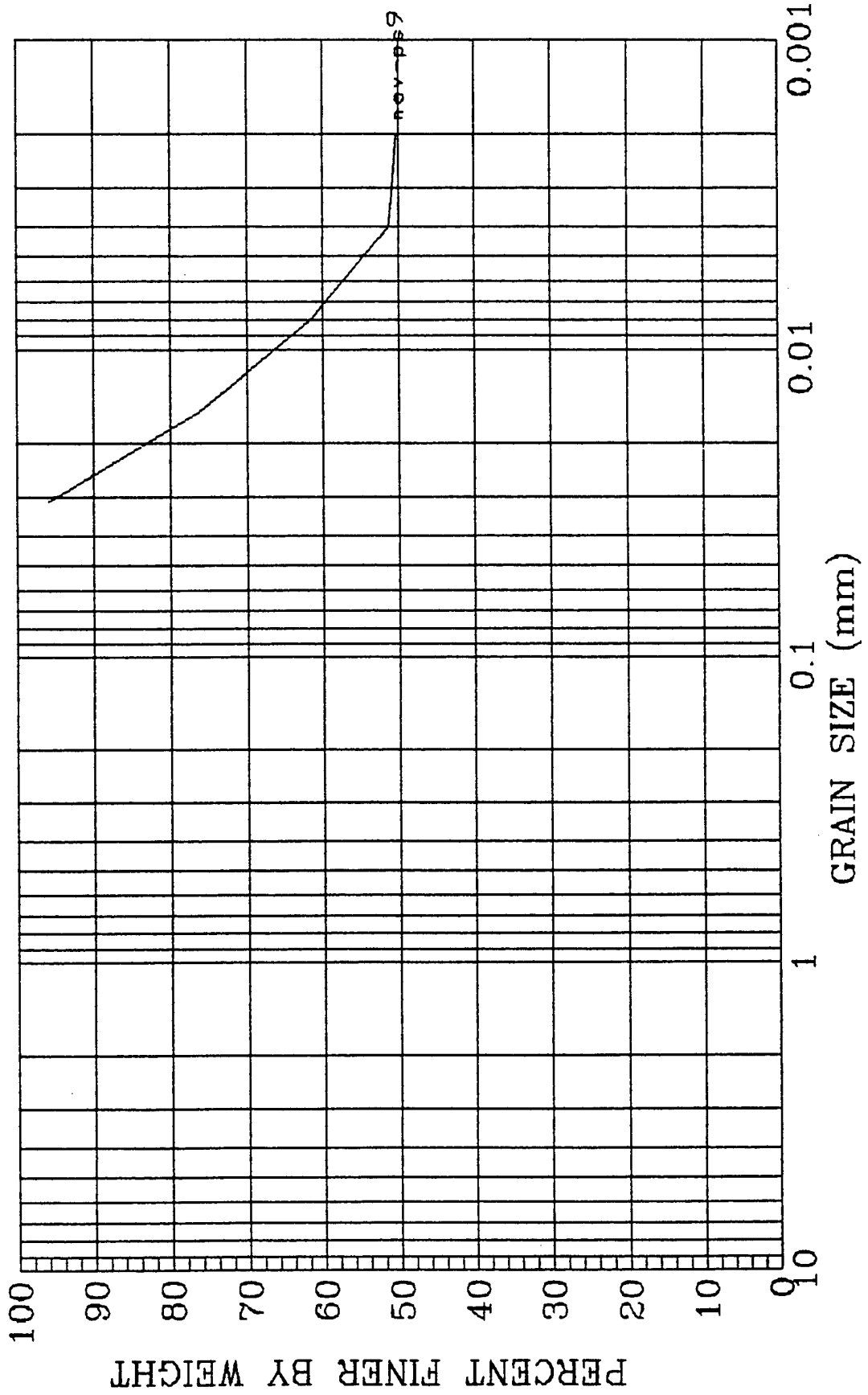
ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 07/22.23/91
TIME: ps7(1500-1507)ps8(1625)
SITE: goose island
STATION: 2B



ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

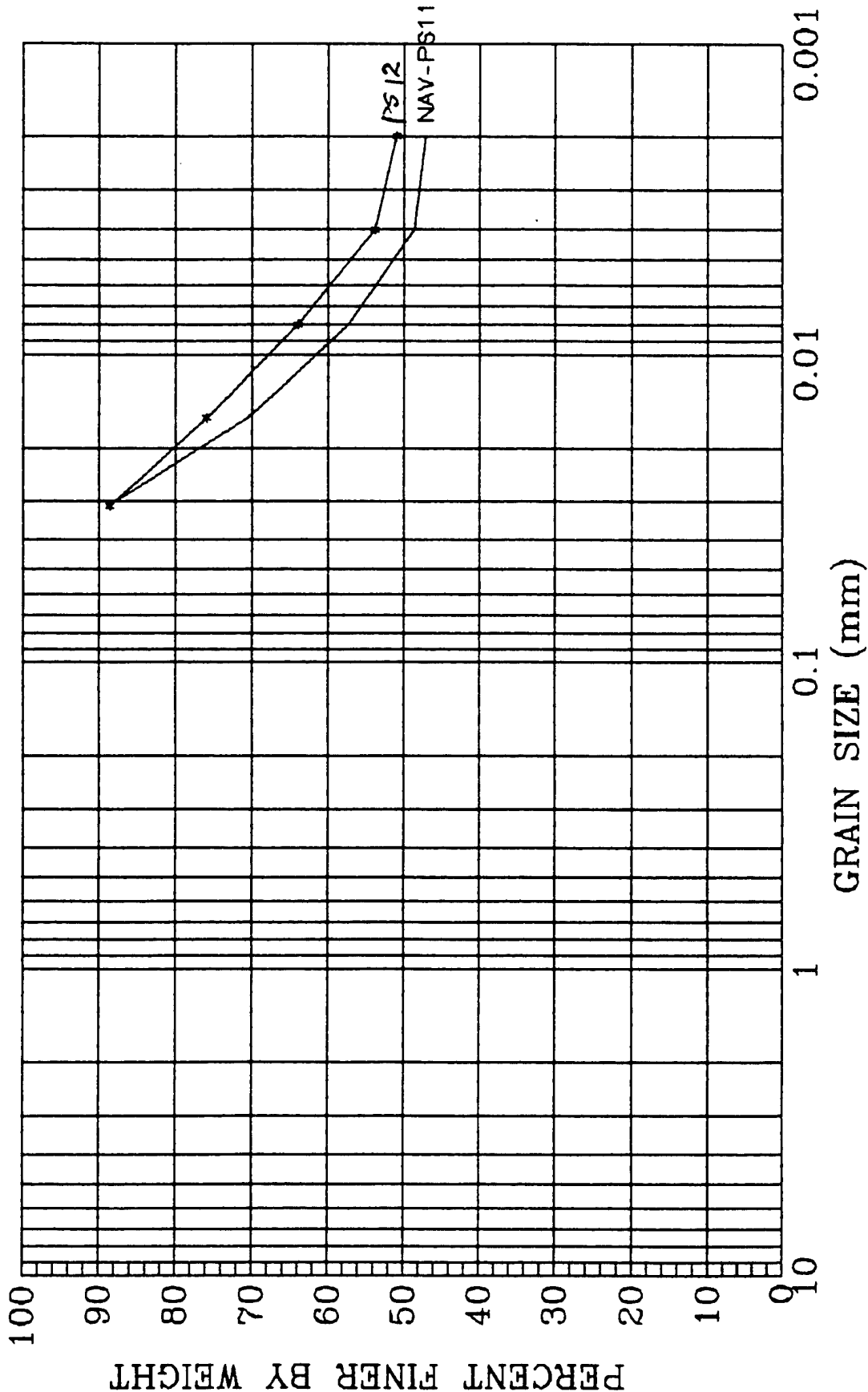
PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 07/22/91
TIME: ps9(1636)
SITE:goose island.station 4 A
COMMENTS:



LAB. NO. 408
LAB. NO. 409

ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

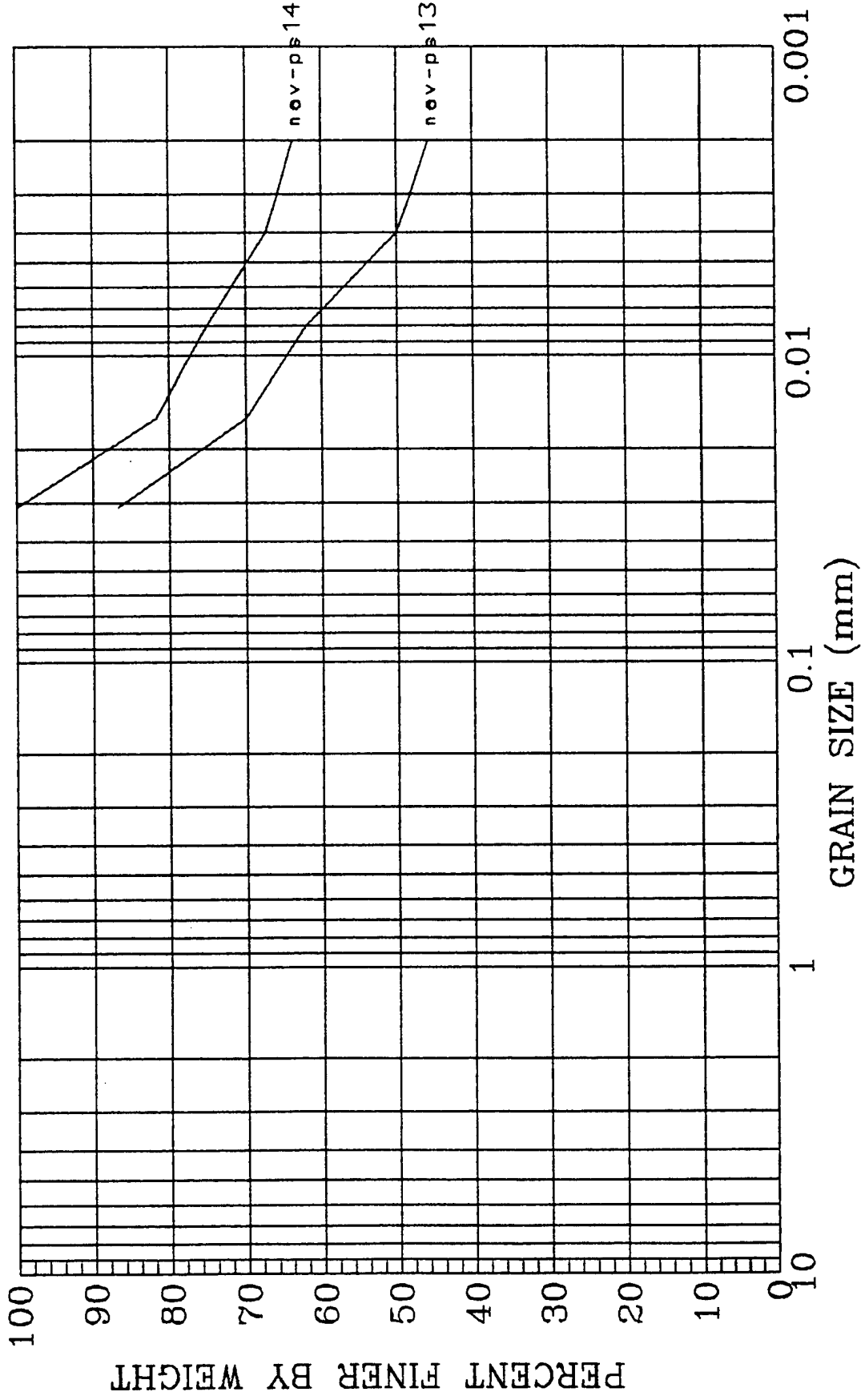
PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 07/22/91
TIME: PS11(1438-1445)PS12(1637-1642)
SITE: goose island.station 4 B
COMMENTS:



LAB. NO. 410
LAB. NO. 411

ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

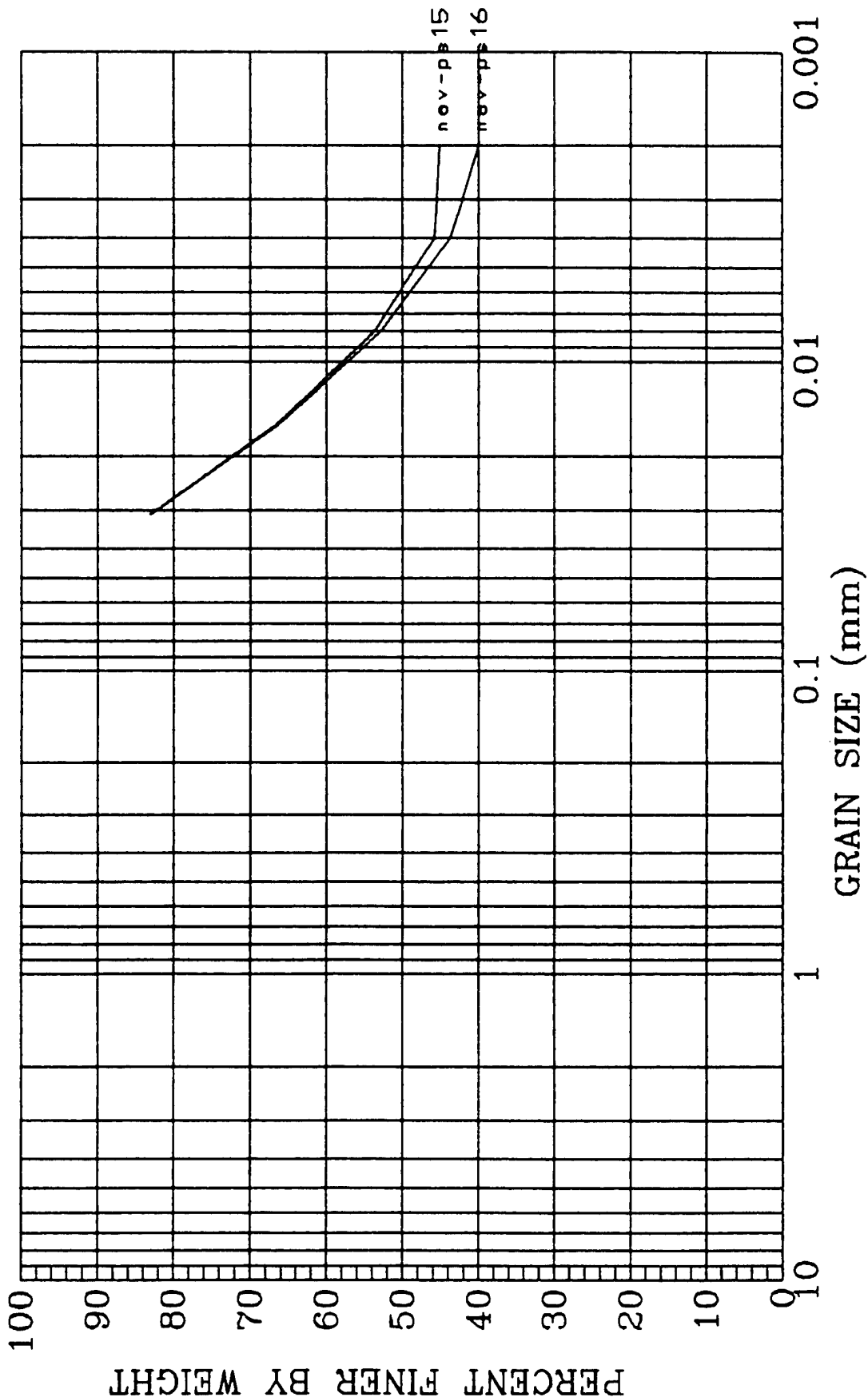
PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 07/23/91
TIME: ps13(1145)ps14(1500)
SITE: goose island
STATION: PS13 4B.ps14 5?



LAB. NO. 412
LAB. NO. 413

ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

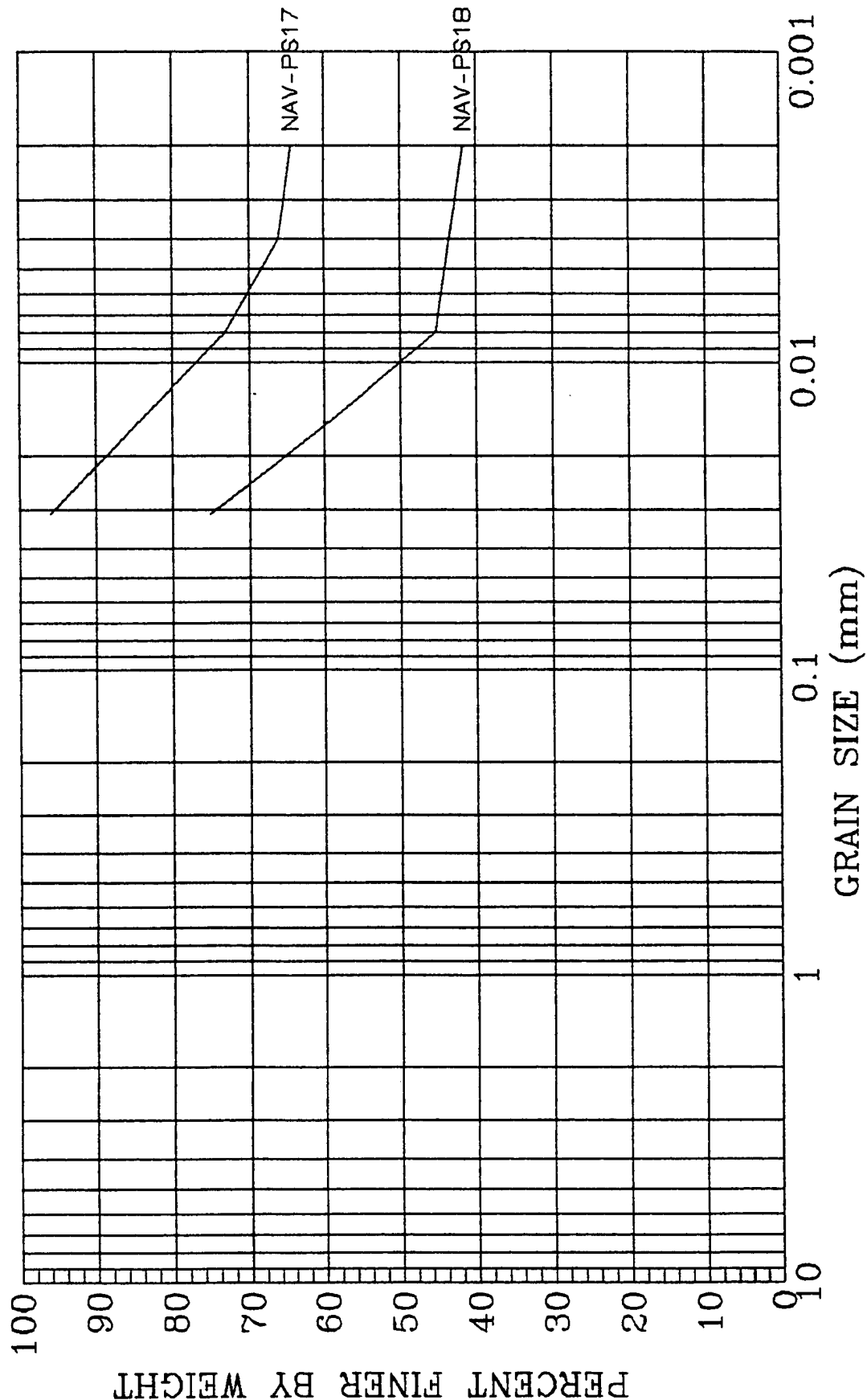
PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 07/23/91
TIME: ps15(1145)ps16(1630)
SITE: goose island.
STATION: PS15 5A.PS16 5A



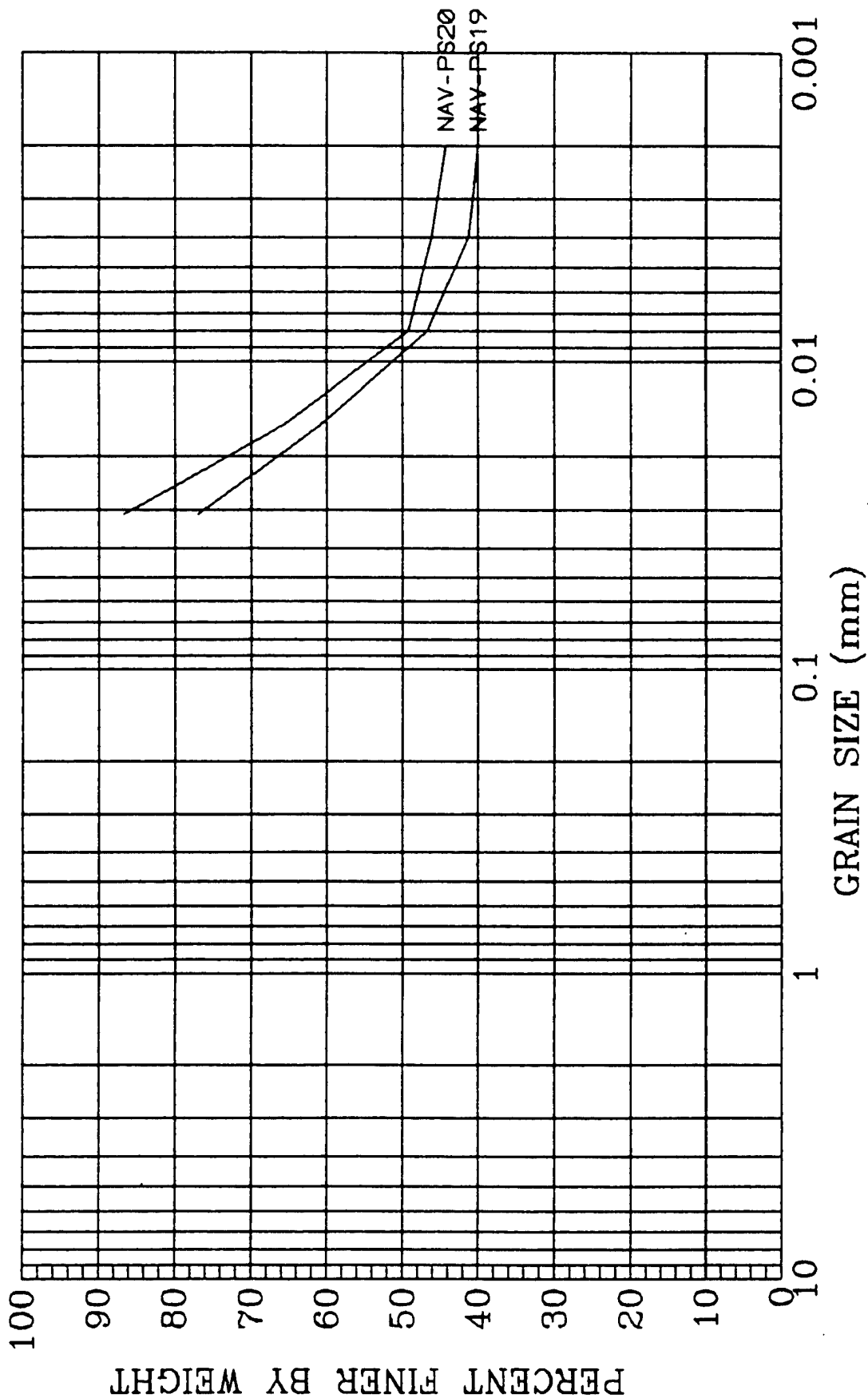
LAB. NO. 414
LAB. NO. 415

ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 07/22/91
TIME: PS17(1710?)PS18(1630)
SITE: goose island
STATION: PS17 4A PS18 4B



PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 07/23/91
TIME: ps19(1145)ps20(1630)
SITE: goose island
STATION: PS19 4A PS20 4A



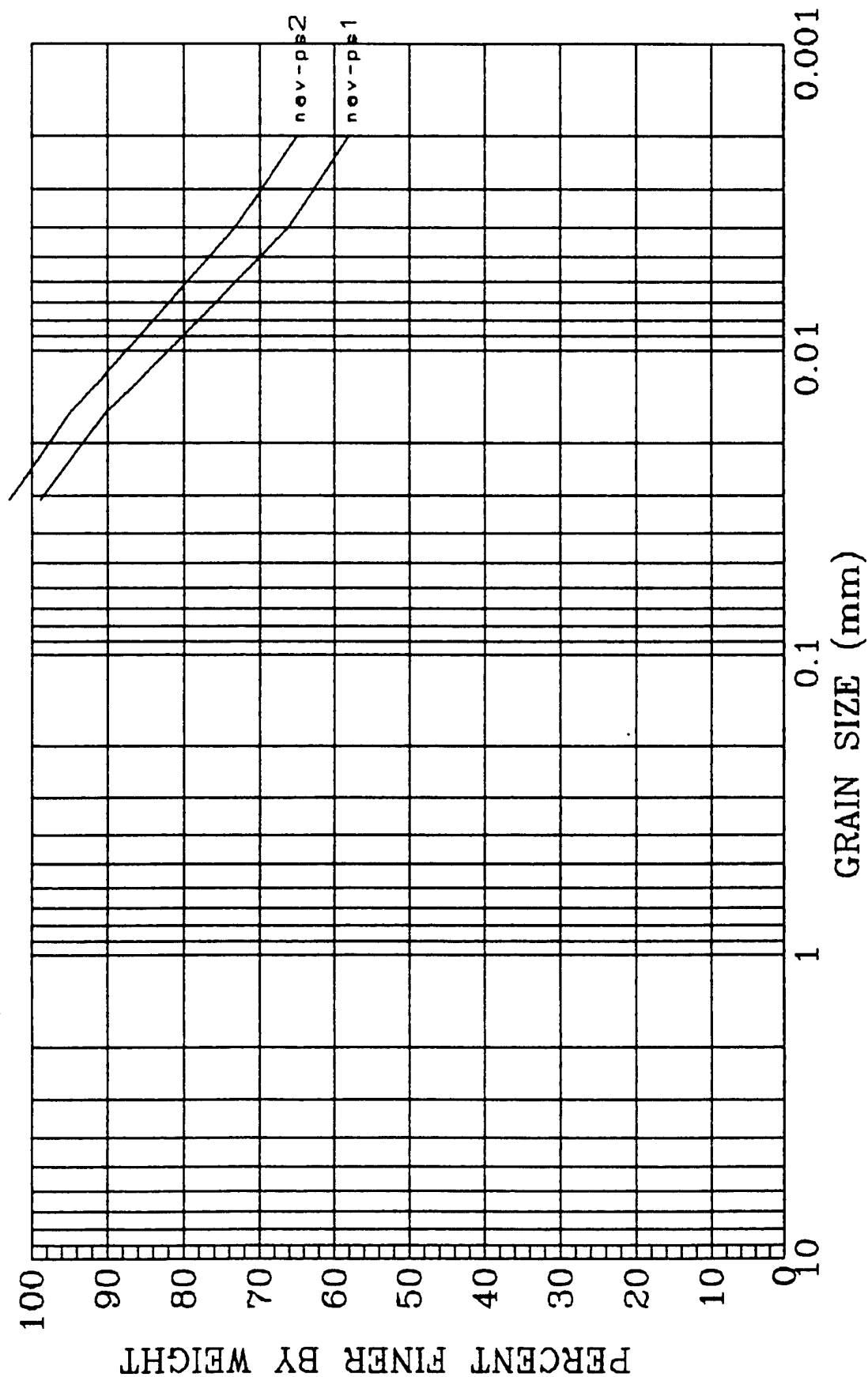
**List of Suspended Sediment Particles Analyzed,
Clarks Ferry, Trip 1**

<i>Date</i>	<i>Time</i>	<i>Intake station</i>	<i>Dry weight, g</i>	<i>Lab No.</i>
05/18/91	11:19 - 11:28	a1	5.6440	418
	11:19 - 11:28	a2	5.4896	419
	11:19 - 11:28	b1	5.2359	420
	11:19 - 11:28	b2	5.2568	423
	11:19 - 11:28	b3	6.0134	424
05/20/91	16:30 - ?	b1	1.8645	421
	16:30 - ?	c2	1.6799	425
05/21/91	10:10 - 10:21	b1	1.4145	422
	10:10 - 10:21	c1	1.5863	426
	17:01 - 17:14	e1	2.9209	427
	17:01 - 17:14	e2	7.6477	428

LAB. NO. 418
LAB. NO. 419

ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

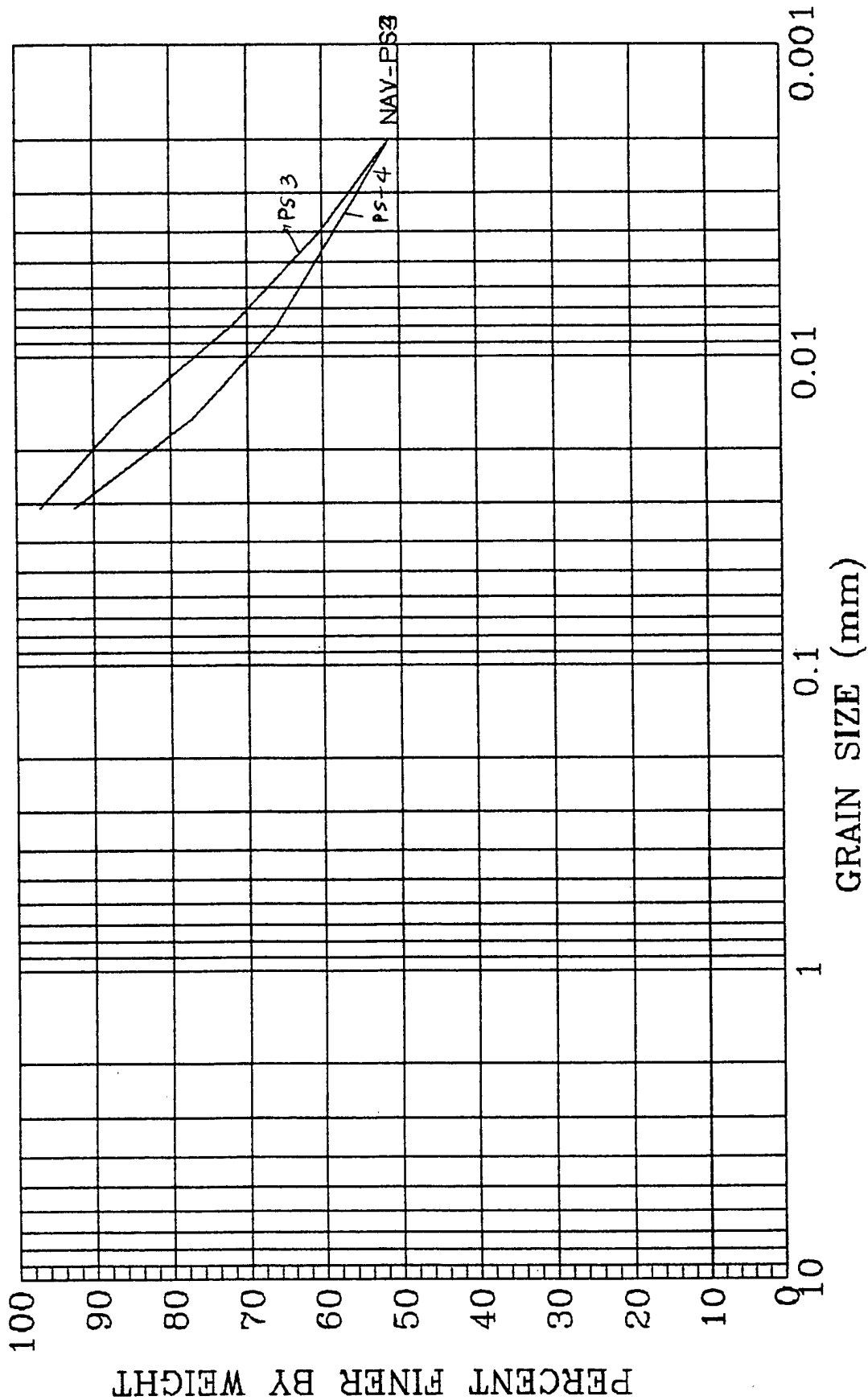
PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 05/18/91
TIME: ps1(1119-1128)ps2(1119-1128)
SITE: clarks ferry
STATION: PS1(1A 12")PS2(1B 30")



LAB. NO. 420
LAB. NO. 421

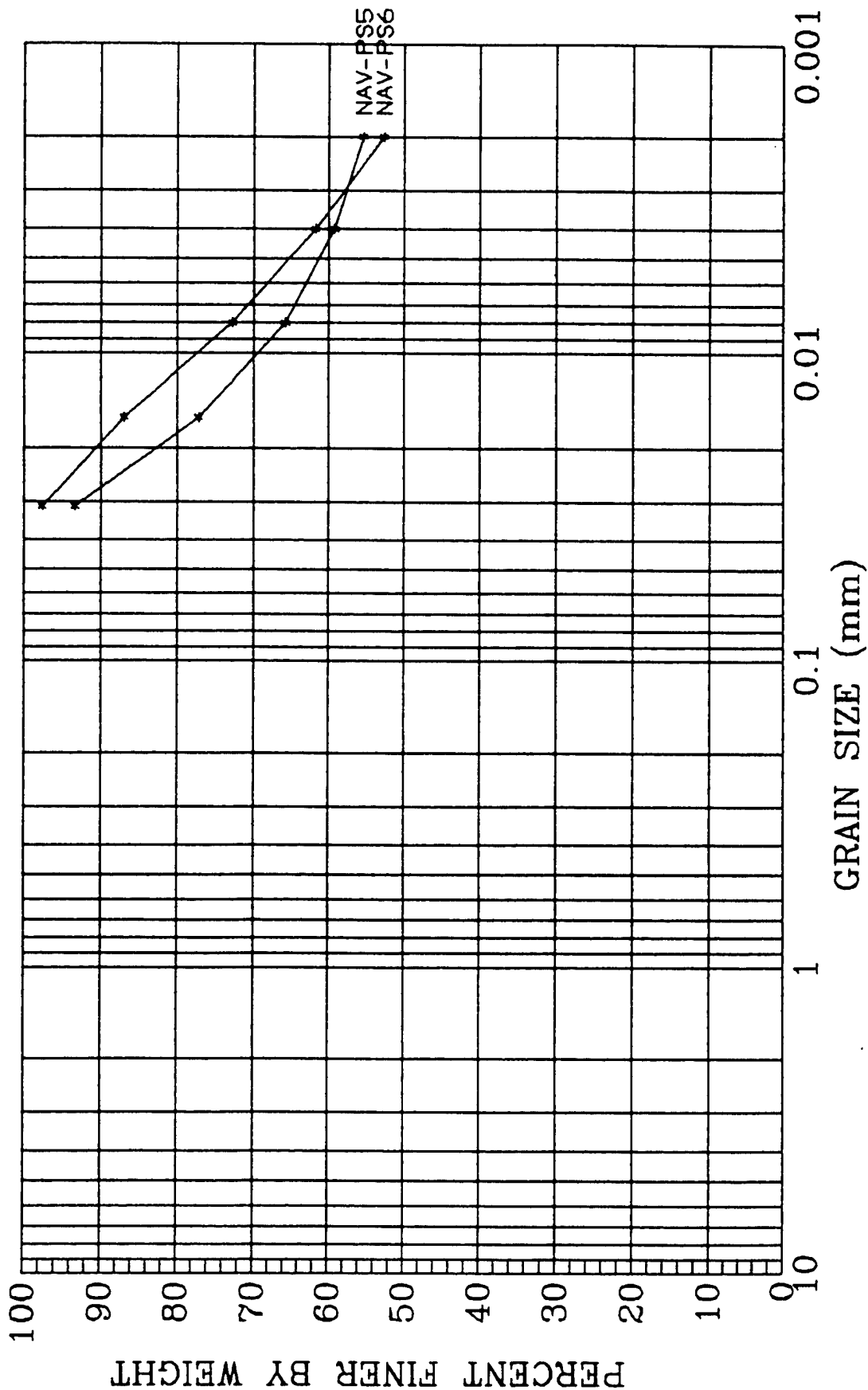
ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 05/18.20/91
TIME: PS3(1119-1128)PS4(1630)
SITE: Clarks ferry
STATION: 2A 12"



ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 05/21/91
TIME: PS5(1010-1020)PS6(11
SITE: Clarks ferry
STATION:PS5(2A 12")PS6(2B 2



ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: navigation impact

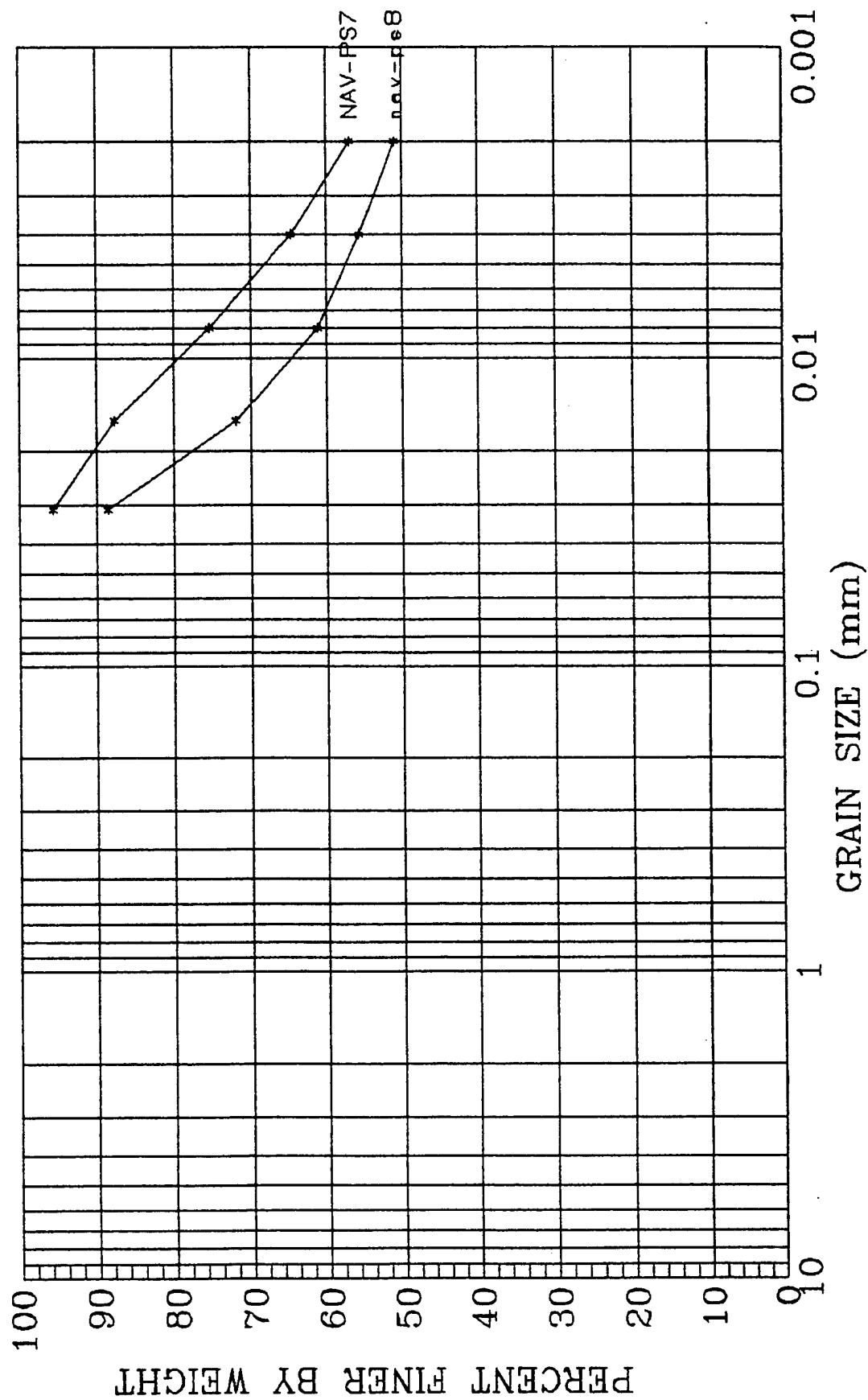
ANALYSIS DATE: 10/94

COLLECTED DATE: 05/20/91

TIME: ps7(1119-1128)ps8(1630)

SITE: Clarks Ferry

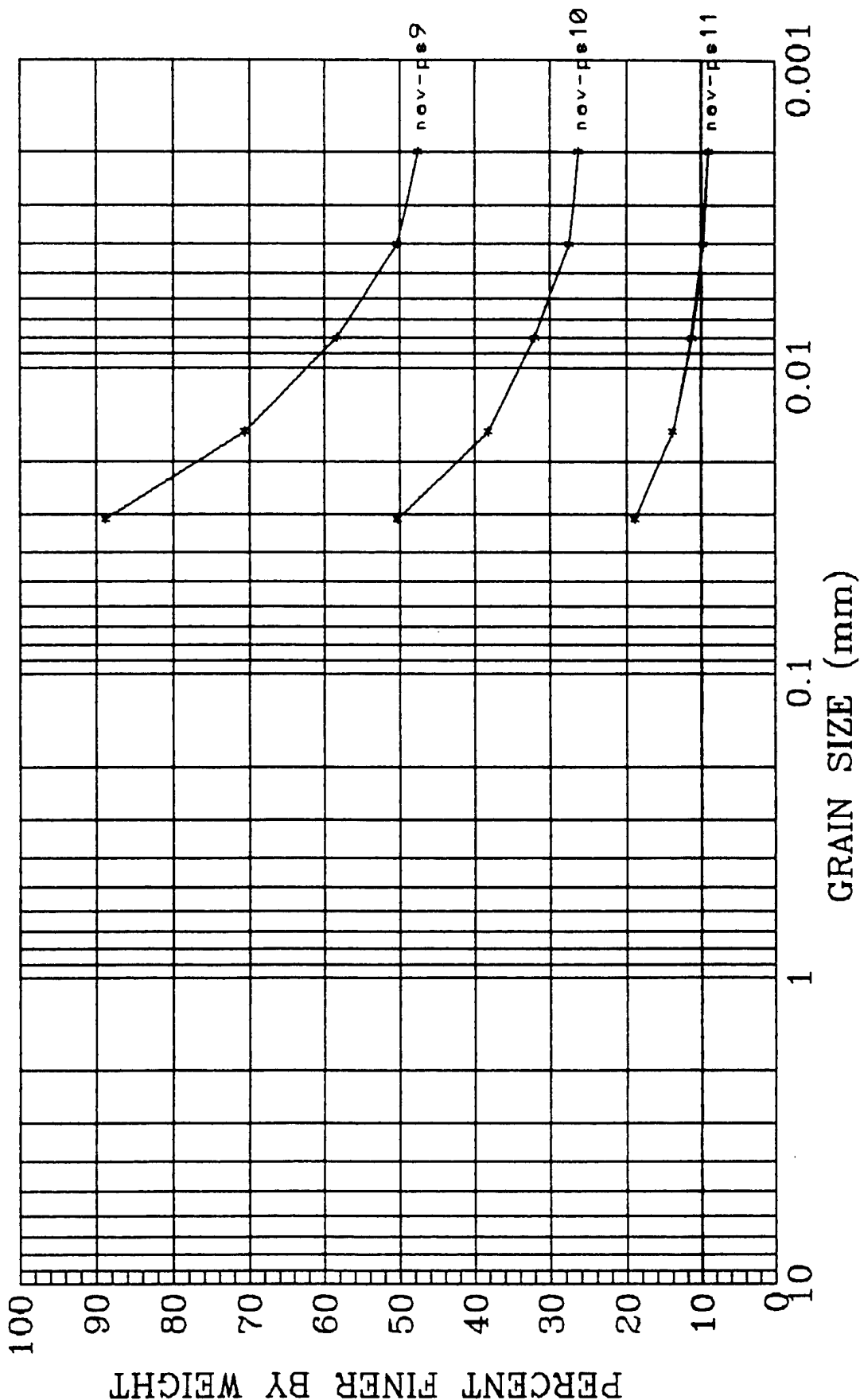
STATION: PS7(2C 18") PS8(3A 12")



LAB. NO. 426
LAB. NO. 427
LAB. NO. 428

ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 10/94
COLLECTED DATE: 05/21/91
TIME: ps9(1010-1021)ps10(1701-1714)
TIME: ps11(1701-1714)station5 66"
STATION: ps9 3A 12"ps10 5? 12"



**List of Suspended Sediment Particles Analyzed,
Kampsville, Trip 1**

<i>Date</i>	<i>Time</i>	<i>Intake station</i>	<i>Dry weight, g</i>	<i>Lab No.</i>
10/12/90	10:45 - 10:53	a1	1.1636	429
	10:40 - 10:53	a2	0.6856	432
	10:45 - 10:54	b1	1.2947	435
	10:45 - 10:53	b2	1.2115	438
	10:45 - 10:54	c1	1.1397	440
	10:45 - 10:54	c3	1.1964	443
10/13/90	13:12 - 13:17	a1	1.1918	430
	13:12 - 13:19	a2	1.3155	433
	13:12 - 13:18	b1	1.6101	436
	13:12 - 13:18	b2	1.4479	439
	13:12 - 13:18	c1	1.8757	441
	13:12 - 13:18	c3	1.6491	444

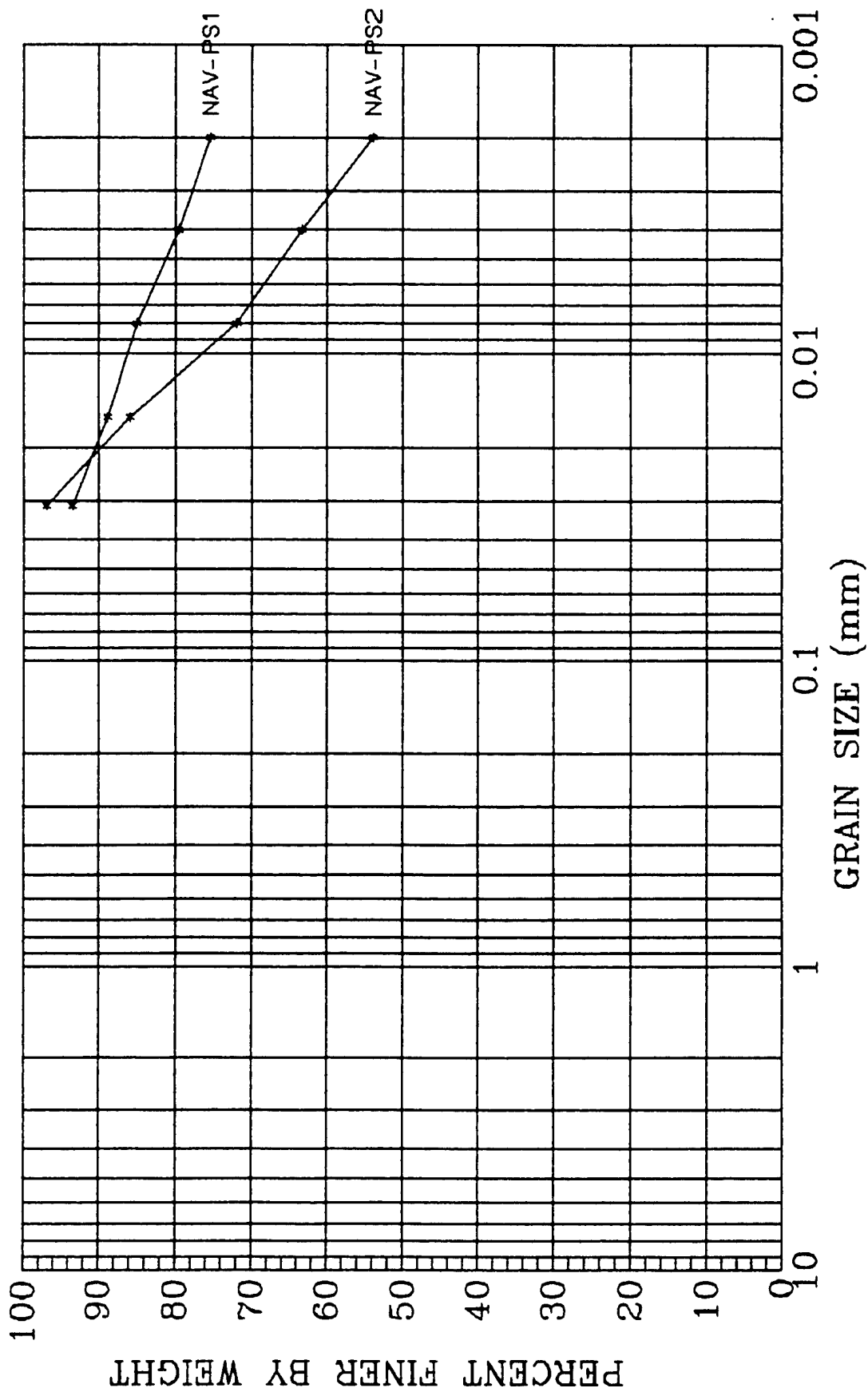
(During Barge-Tow Passage)

<i>Date</i>	<i>Time</i>	<i>Barge</i>	<i>Intake station</i>	<i>Dry weight, g</i>	<i>Lab No.</i>
10/15/90	09:48 - 09:54	A. Randall	a1	1.8782	431
	09:48 - 09:54	A. Randall	a2	1.8800	434
	09:48 - 09:54	A. Randall	b1	1.9839	437
	09:48 - 09:54	A. Randall	c1	2.0329	442
	09:48 - 09:54	A. Randall	c3	1.8598	445

LAB. NO. 429
LAB. NO. 430

ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 12/94
COLLECTED DATE: 10/12/90
TIME: PS1(1045-1053)PS2(1312-1317)
SITE: Kampsvill
STATION: PS1(1A 6" Background)
ps2(1A Background)



ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: navigation, impact

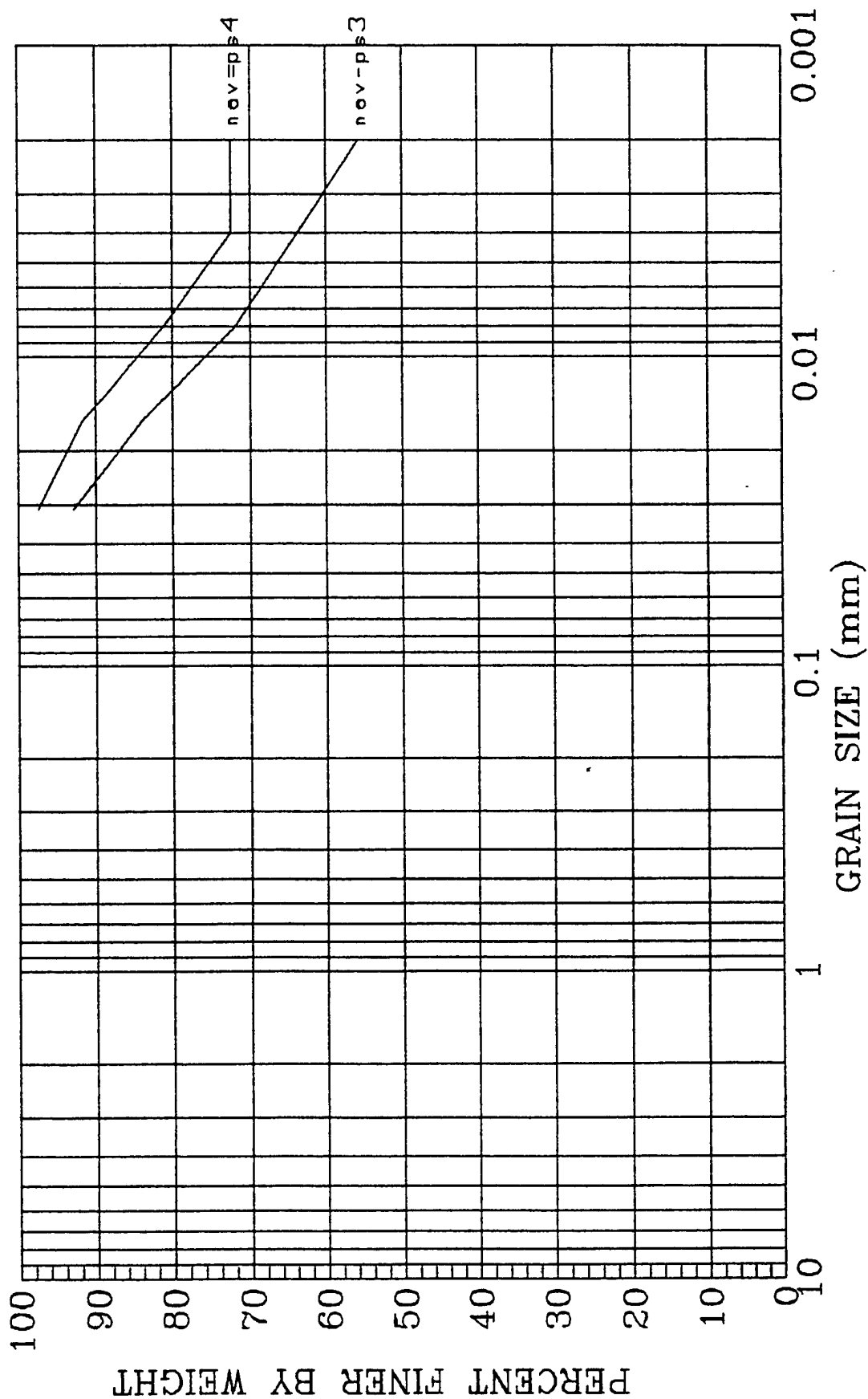
ANALYSIS DATE: 01/06/95

COLLECTED DATE: 10/90

TIME: ps3(948-954)ps4(1040-1053)

SITE: kampsvill

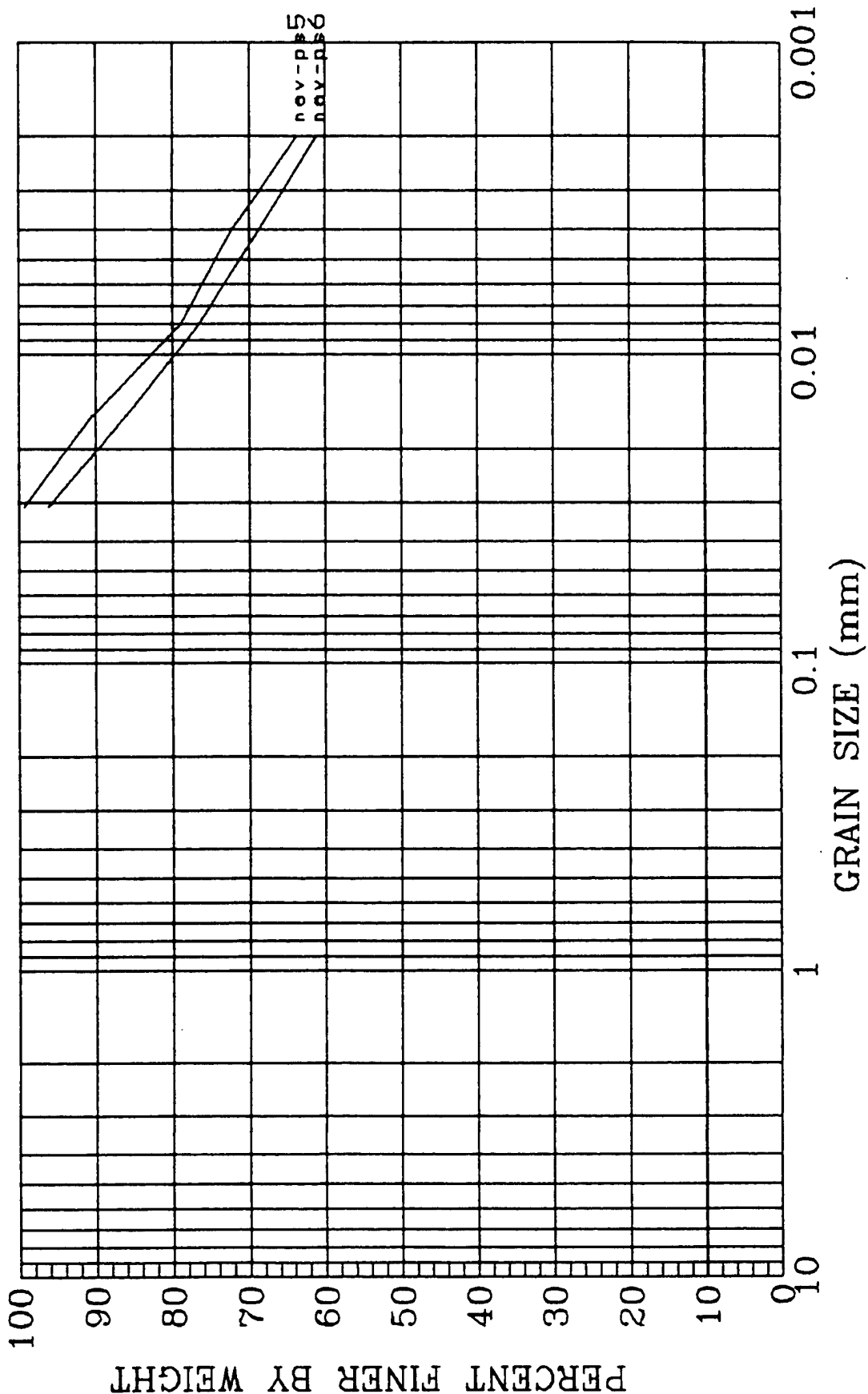
STATION:PS3(1A event)ps4(1B Background)



LAB. NO. 433
LAB. NO. 434

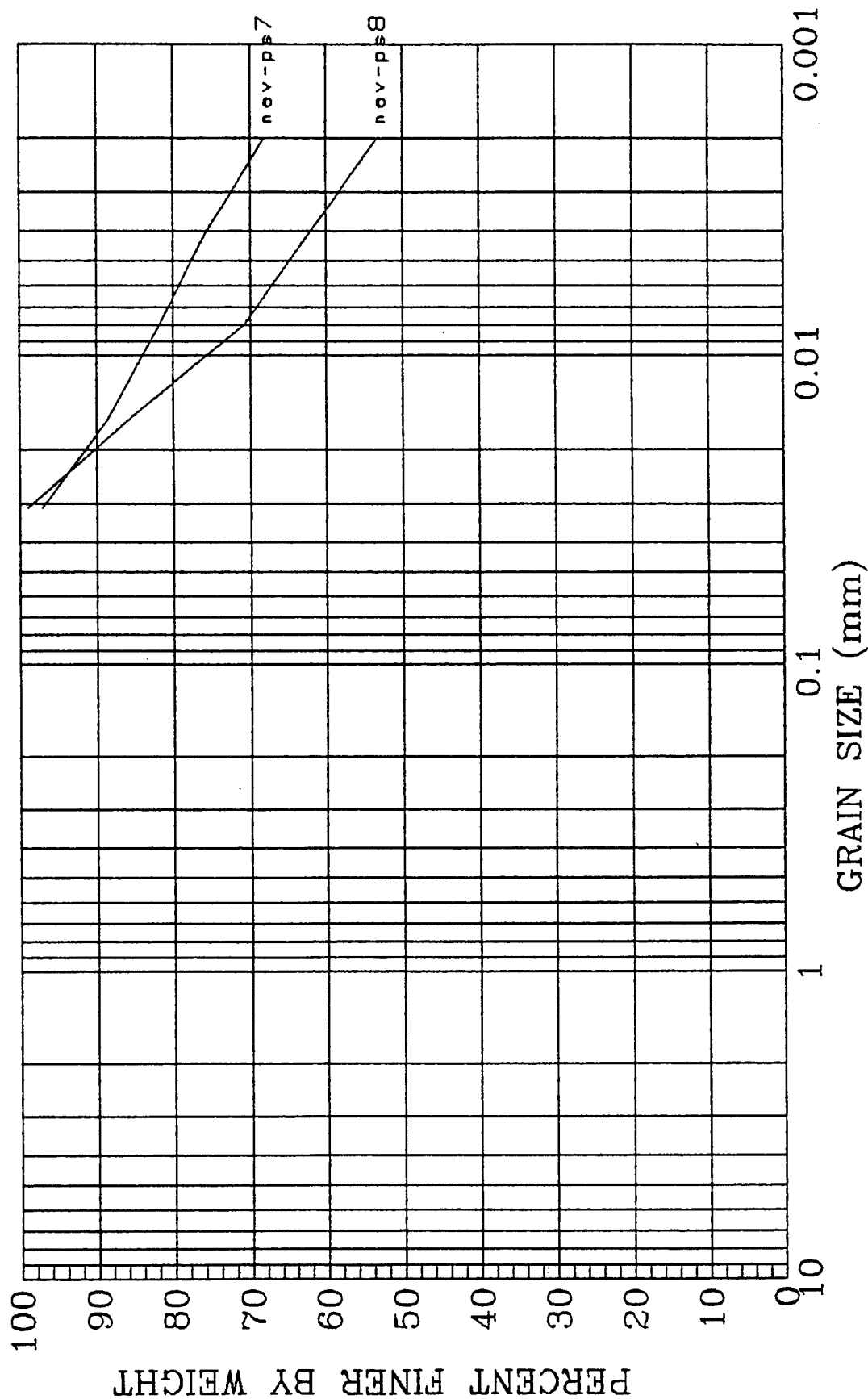
ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 01/95
COLLECTED DATE: 10/90
TIME: ps5(1312-1319)ps6(948-954)
SITE: Kampsvill
STATION: PS5(1B Background)ps6(1B Event)



LAB. NO. 435
LAB. NO. 436

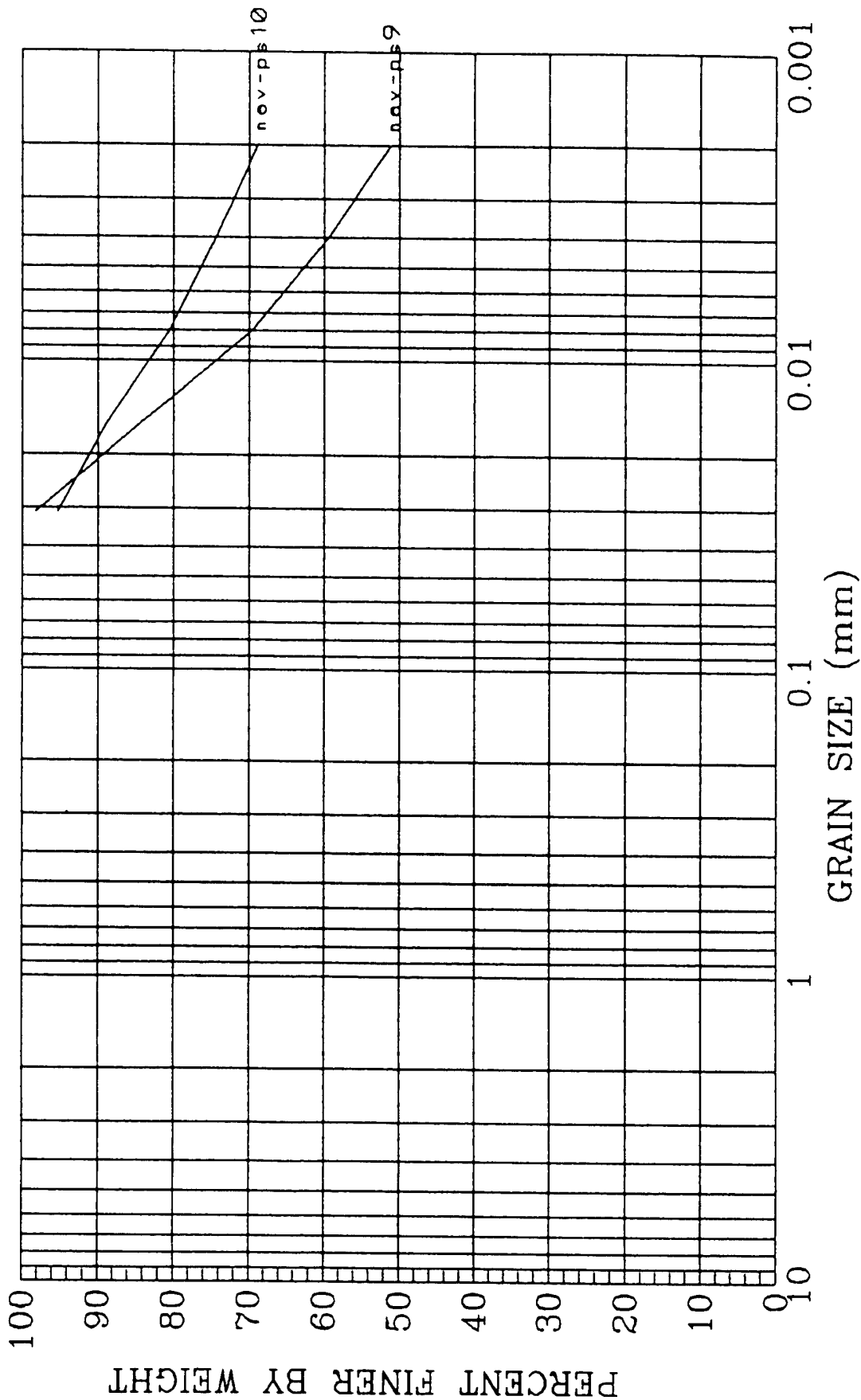
PROJECT: navigation impact ILLINOIS STATE WATER SURVEY
ANALYSIS DATE: 01/95
COLLECTED DATE: 10/90
TIME: ps7(1045-1054)ps8(1312-1318)
SITE: Kampsvill
STATION: PS7(2A Background)



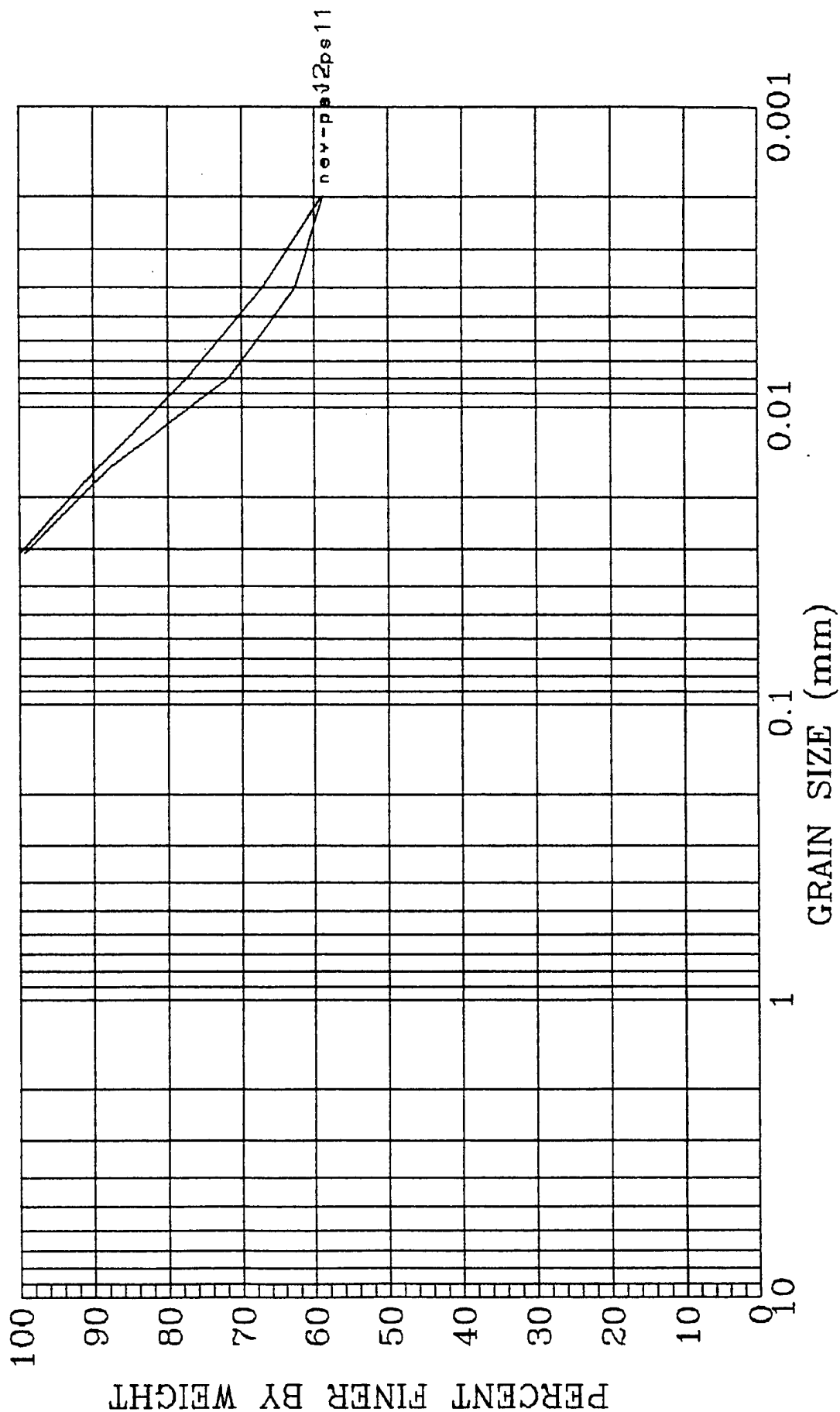
LAB. NO. 437
LAB. NO. 438

ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 01/95
COLLECTED DATE: 10/90
TIME: ps9(948-954)ps10(1045-1053)
SITE: Kampsvill
STATION: ps9(2A Event)ps10(2B Background)

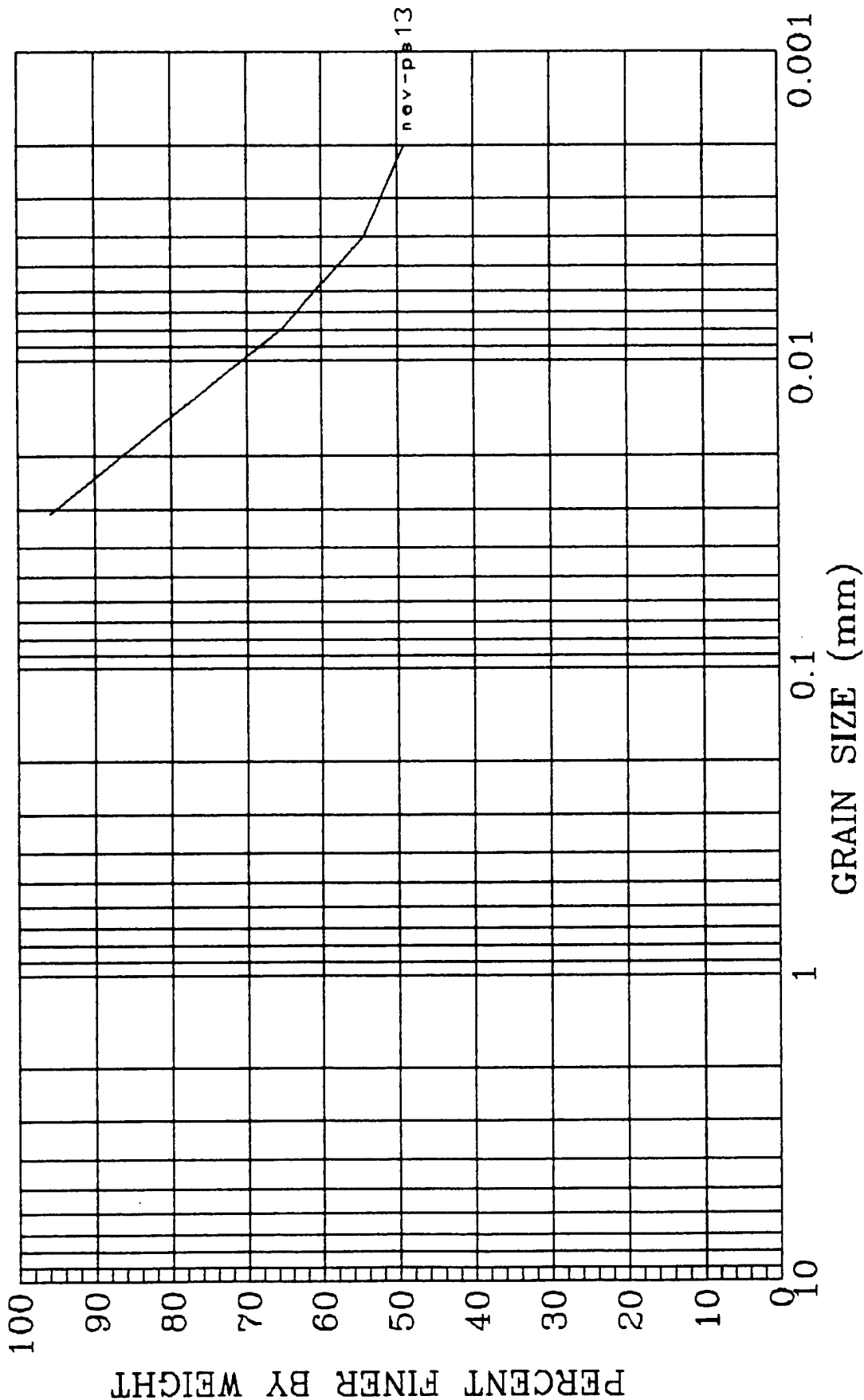


ps12(3A Background)



ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact
ANALYSIS DATE: 01/95
COLLECTED DATE: 10/90
TIME: 1312-1318
SITE: Kampsvill
STATION: 3A Background



ILLINOIS STATE WATER SURVEY SEDIMENT LABORATORY

PROJECT: navigation impact

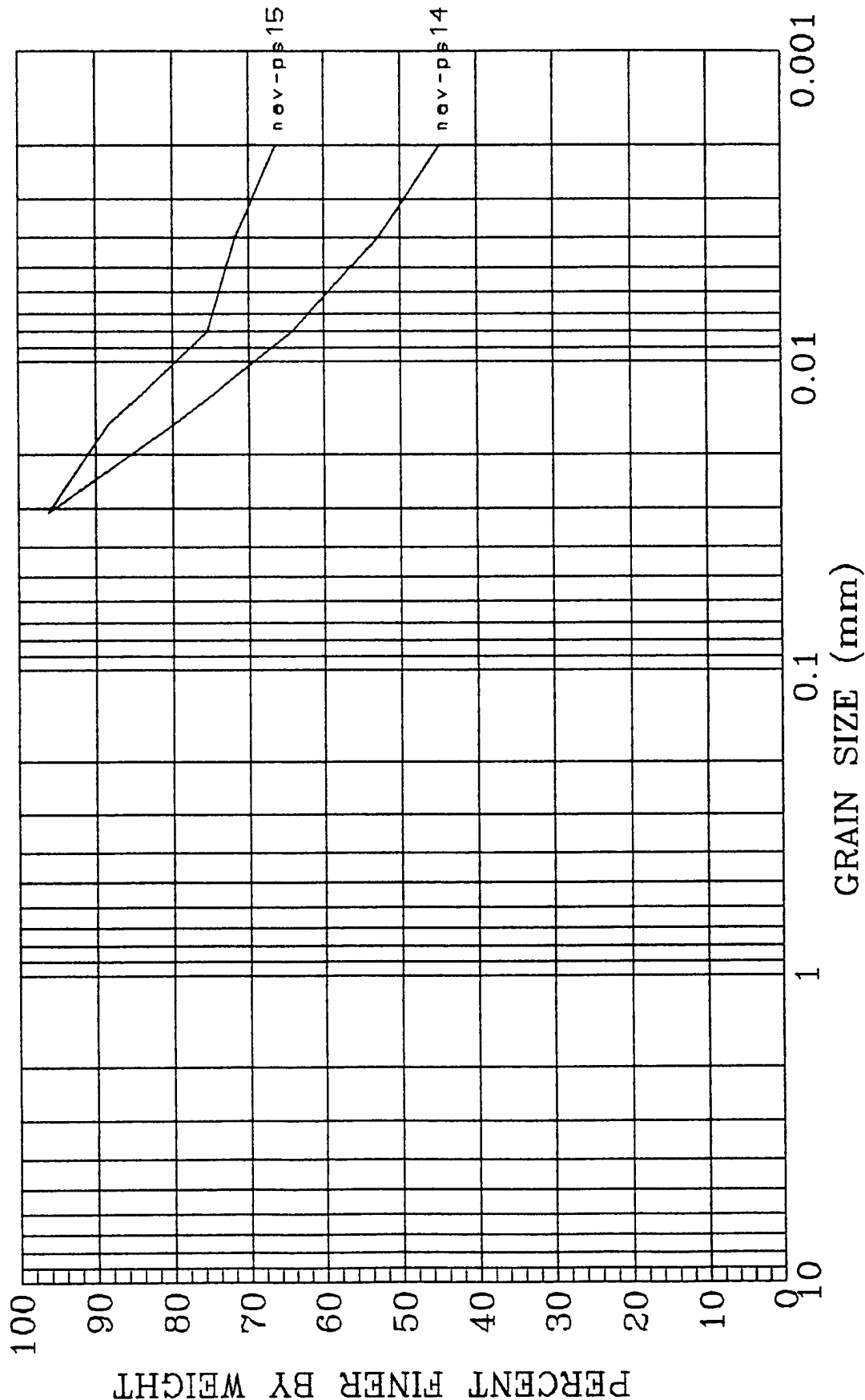
ANALYSIS DATE: 01/95

COLLECTED DATE: 10/90

TIME: ps14(948-954)ps15(1045-1054)

SITE: Kampsvill

STATION: PS14(3A Event)ps15(3c Background)



LAB. NO. 444
LAB. NO. 445

ILLINOIS STATE WATER SURVEY
SEDIMENT LABORATORY

PROJECT: navigation impact

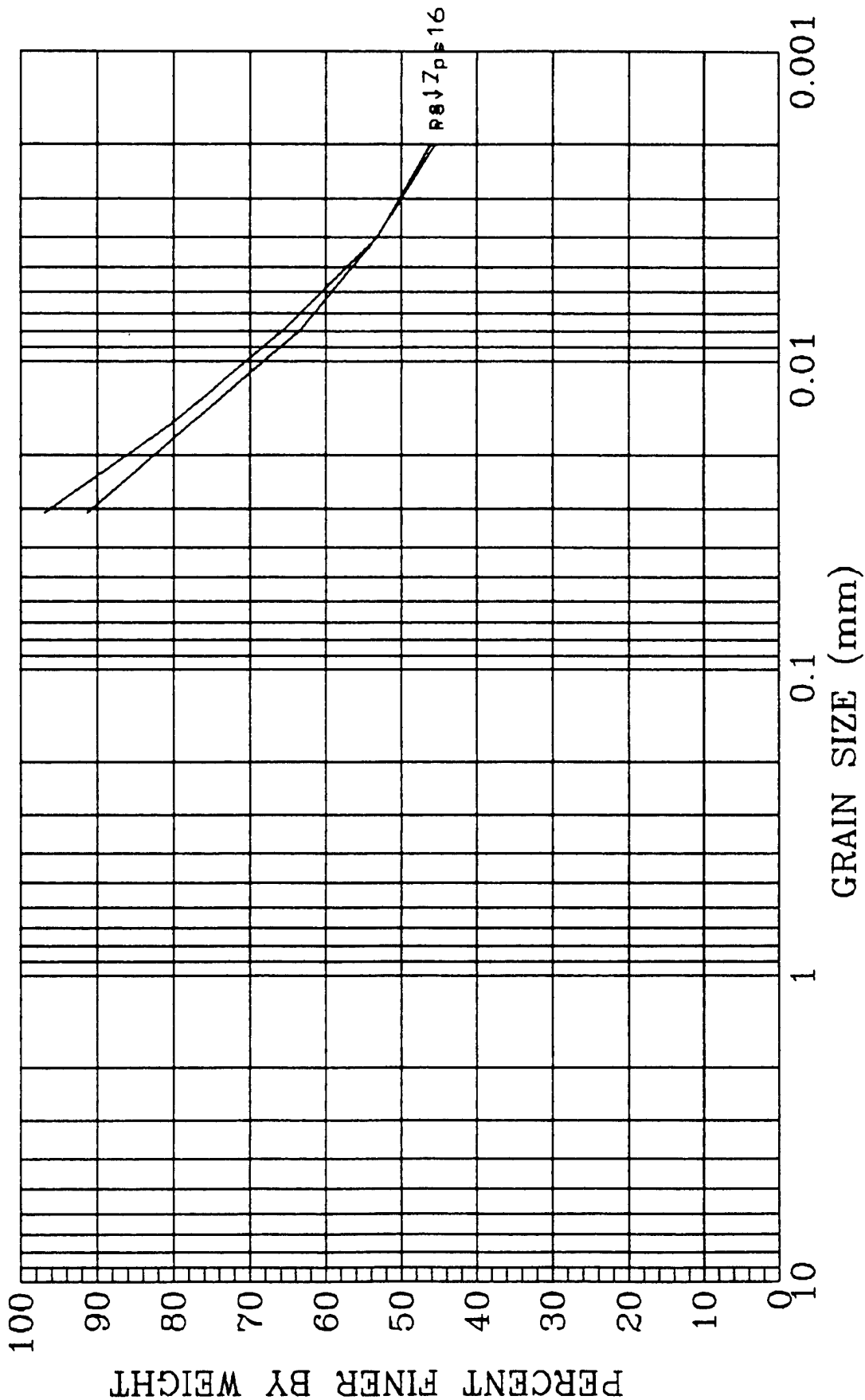
ANALYSIS DATE: 01/95

COLLECTED DATE: 10/90

TIME: ps16(1312-1318)ps17(948-954)

SITE: Kampsvill

STATION: PS16(3C Background)ps17(3c Event)



APPENDIX XXX.

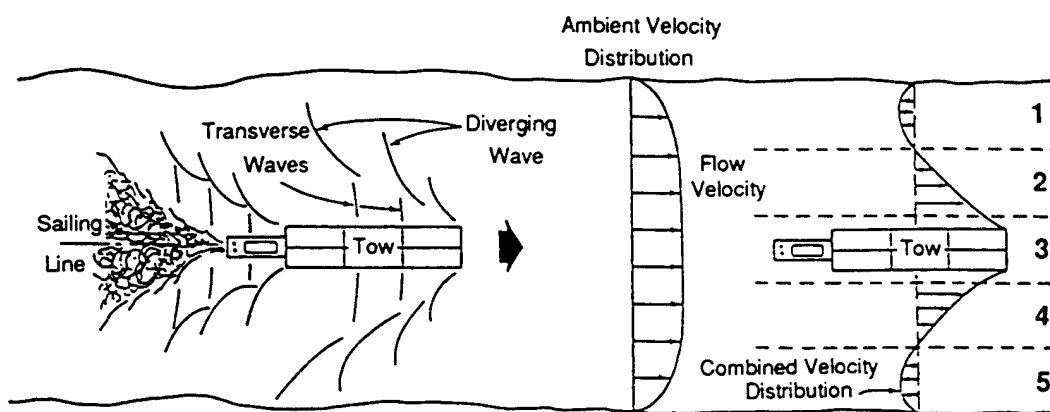
A PREDICTIVE METHOD FOR MAXIMUM RETURN VELOCITY

CROSS-SECTIONAL DISTRIBUTION OF RETURN FLOW

The variation of flow velocity from barge to bank is important for any study on the physical changes caused by navigation traffic. There are few available methods to compute the shape of the lateral velocity distribution. In all the methods, the predicted return velocity distributions decrease exponentially with distance from the barge to the shoreline.

However, using velocity data collected from a natural river such as the Illinois River, a distinct lateral distribution of the return flow can be observed. It is seen that barge movements either upstream or downstream generate a pronounced return current that has a much broader width from the shoreline and moves in the direction opposite the motion of the barge. On the other hand, the velocity at the wall of the barge should be equal to the barge speed, because of the no-slip condition. Thus, based on the continuity relationship, there should exist a location, probably near the barge, where the return velocity is zero. For the purpose of determining the lateral velocity distribution and the development of an equation, the channel is conceptually subdivided into four lateral subchannels, each extending from the water surface to the river bed (figure XXX-1). In this figure, it is assumed that the channel geometry is symmetrical. Most of the velocity data were collected from subchannel 4 at four lateral locations at the Kampsville site.

Figure XXX-1 indicates that subchannels 2 and 3 located on either side of the barge are narrow. Thus water probably moves along with the barge. A quantification of the velocity distribution within these two subchannels must be done within a laboratory setup since it is almost impossible to collect field data in a natural river within such close proximity to the barge. The flow within subchannels 2 and 3 may be called shear flow. At the wall of the barge, current velocity should be equal to the barge speed. Away from the barge boundary, it is assumed that the flow velocity decreases almost linearly and becomes zero at a certain lateral location. This location can



XXX-1. Conceptual distribution of return velocity across the width of a channel due to barge-tow movement

be approximated by using the conservation of water volume. The volume of water moving at any instant in subchannel 4 or 1 should be equal to the volume of water in subchannel 3 or 2. Using this concept, it is possible to predict the location along the width of the river away from the barge where the flow velocity is equal to zero. In other words, the width of subchannel 3 or 2 can be determined. Introducing $\eta = y/W_s$ as the nondimensional width of the channel and t_s as the width of subchannel 3 or 2, where y is the distance from the barge and W_s is the distance of the barge from the shoreline, the region of these two subchannels extends from $\eta = 0$ to $\eta = \eta_0 = t_s/W_s$. The values of η_0 should be dependent on the barge-tow configuration, barge speed, and barge draft. Thus, η_0 can be related with the barge length Froude number $u_s/(gL)^{0.5}$ and draft Froude number $u_s/(gd)^{0.5}$, where L is the barge length.

Figure XXX-2 shows the relationship between η_0 and the product of the above two Froude numbers for either upstream or downstream-bound barges. Based on data from the 11 events, Eqs. (1) and (2) for determining η_0 have been developed as:

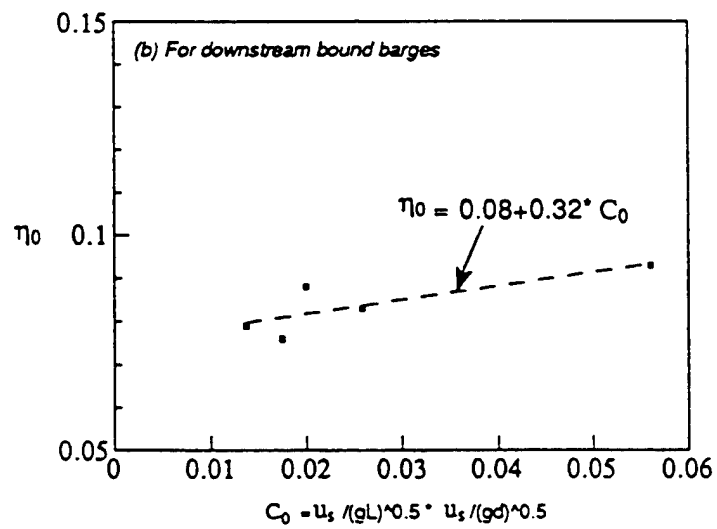
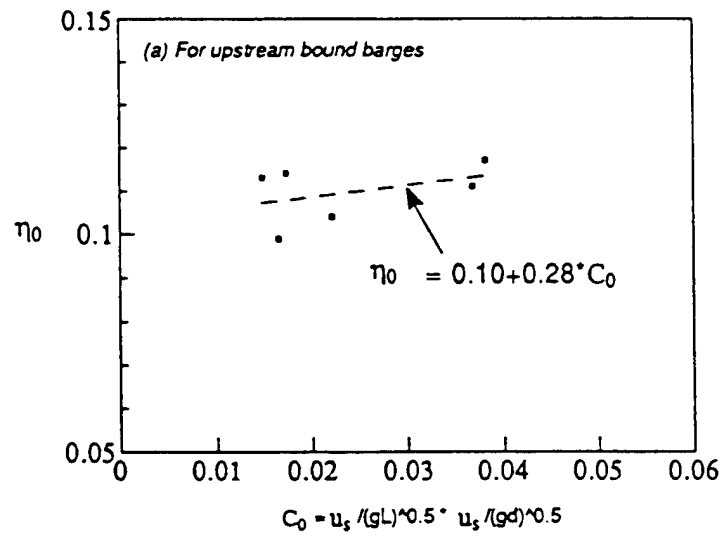
$$\eta_0 = 0.10 + 0.28 C_0 \quad (\text{upstream-bound barges}) \quad (1)$$

and

$$\eta_0 = 0.08 + 0.32 C_0 \quad (\text{downstream-bound barges}) \quad (2)$$

where $C_0 = \{u_s/(gL)^{0.5}\} \{u_s/(gd)^{0.5}\}$.

Subchannels 1 and 4 located near the shore are fairly wide. In these two subchannels, all the fluid particles are assumed to move in one direction, which is opposite that of the barge motion from the zone of higher pressure to lower pressure. This flow within subchannels 1 and 4 is return flow, or parallel flow, and its distribution follows a parabola-like shape. The region of subchannels 4 and 1 extends from $\eta_0 = t_s/W_s$ to $\eta = 1$. Thus, it appears that two different types of velocity distribution do exist within two different subchannels when a barge moves within a natural channel.



XXX-2. Variations of η_0 for upstream and downstream bound barges

With this concept in mind, it is postulated that in subchannel 3 or 2, the flow velocity decreases almost linearly from the barge speed u_s at $\eta = 0$ to zero at $\eta = \eta_0$. The lateral distribution of flow velocity can be thought of as a quasilinear profile within these two zones and expressed as:

$$u_1(\eta) = u_s(1 - \eta/\eta_0)(1 - \eta) \quad (0 \leq \eta \leq \eta_0) \quad (3)$$

In subchannel 4 or 1, the flow velocity is zero at the bank boundary ($\eta = 1$) to satisfy the no-slip condition, then gradually increases with the distance from the shoreline, and finally decreases to zero at $\eta = \eta_0$. The lateral velocity distribution of this return flow in these two subchannels is parabola-like and can be expressed as:

$$u_2(\eta) = a_1(1 - \eta)(\eta_0 - \eta)\exp(a_2\eta)/(a_2\eta)^m \quad (\eta_0 \leq \eta \leq 1) \quad (4)$$

where a_1 and a_2 are coefficients to be determined based on field data. The coefficient a_1 physically represents the pressure gradient. Thus, a_1 is related to the blocking factor, A_m/A_c , and the barge draft Froude number, $u_s/(gd)^{0.5}$. Figure XXX-3 shows the relationship between a_1 and the product of the blocking factor and draft Froude number, C_1 , for upstream- and downstream-bound barges. Based on data from the 11 events, Eqs. (5) and (6) for determining a_1 have been developed as:

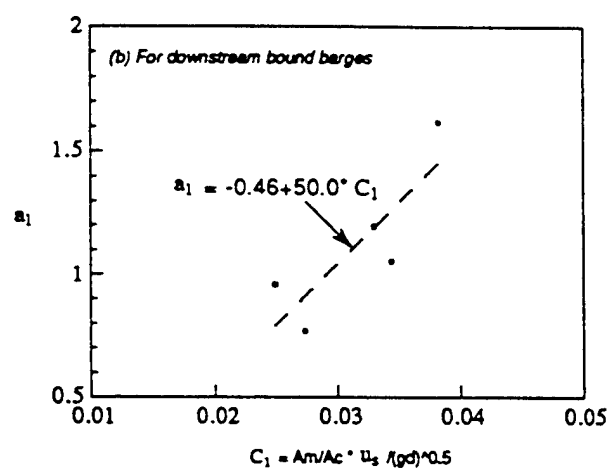
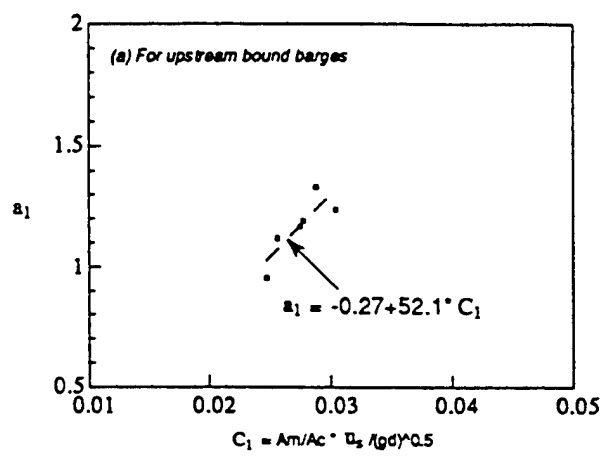
$$a_1 = -0.27 + 52.1 C_1 \quad (\text{upstream-bound barges}) \quad (5)$$

and

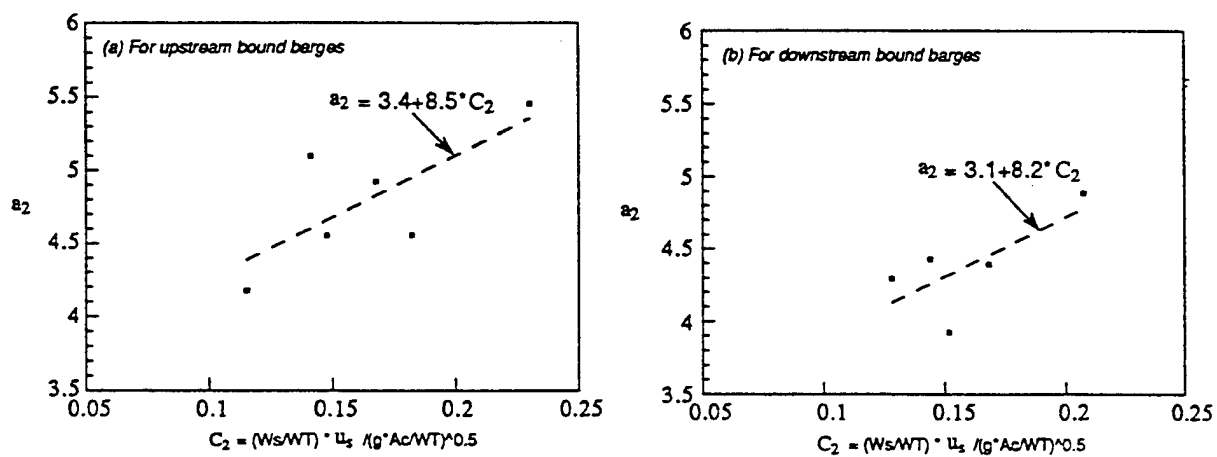
$$a_1 = -0.46 + 50.0 C_1 \quad (\text{downstream-bound barges}) \quad (6)$$

where $C_1 = (A_m/A_c)\{u_s/(gd)^{0.5}\}$.

The coefficient a_2 physically represents the effects of the nonuniformity of the lateral velocity distribution. Thus a_2 is dependent on the relative distance W_s/W_T and the channel Froude number $u_s/(gA_c/W_T)^{0.5}$. The relationship between a_2 and the product of the relative distance and channel Froude number, C_2 , is shown in figure XXX-4 for upstream- and downstream-bound barges. Thus, based on data from the 11 events, Eqs. (7) and (8) for determining a_2 are as follows:



XXX-3. Variations of a_1 for upstream and downstream bound barges



XXX-4. Variations of a_2 for upstream and downstream bound barges

$$a_2 = 3.4 + 8.5 C_2 \quad (\text{upstream-bound barges}) \quad (7)$$

and

$$a_2 = 3.1 + 8.2 C_2 \quad (\text{downstream-bound barges}) \quad (8)$$

where $C_2 = (W_s/W_T) \{u_s/(gA_c/W_T)^{0.5}\}$.

Exponent m in Eq. (4) relates to the existence of the nonuniformity of the velocity distribution across the width of the channel. Thus it is reasonable to expect it to be related with the relative distance and channel Froude number. Such relationships between m and the product of the relative distance and channel Froude number, C_m , are shown in figure XXX-5 for upstream- and downstream-bound barges. Eqs. (9) and (10) describe these relationships as:

$$m = 2.1 + 3.5 C_m \quad (\text{upstream-bound barges}) \quad (9)$$

and

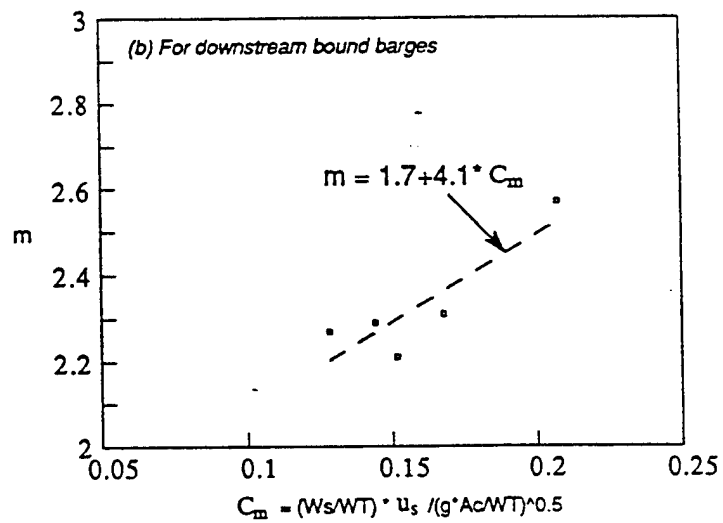
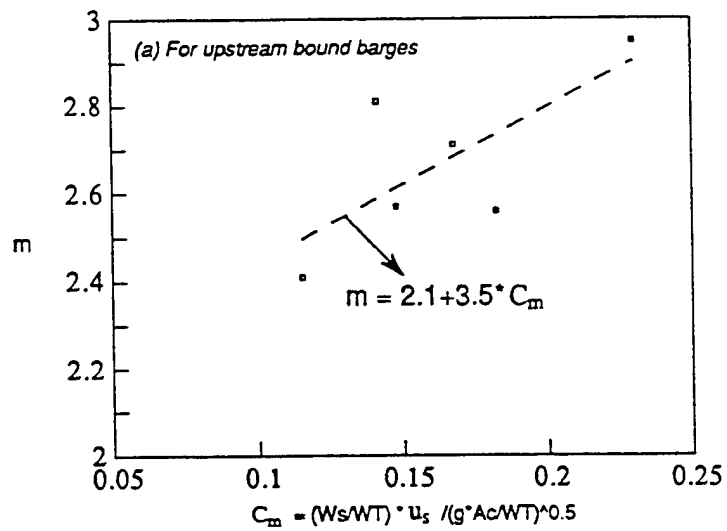
$$m = 1.7 + 4.1 C_m \quad (\text{downstream-bound barges}) \quad (10)$$

where $C_m = (W_s/W_T) \{u_s/(gA_c/W_T)^{0.5}\}$.

The final boundary conditions for the determination of the velocity distribution profile between the barge and the shoreline are: (a) $u = u_s$ at the barge boundary; (b) $u \approx 0$ at η_0 ; and (c) $u = 0$ at the shoreline. The flow velocity distribution across the width of the channel between the barge and the shoreline can thus be written as:

$$\begin{aligned} u_{us}(\eta) &= u_1 + u_2 \\ &= u_s(1 - \eta/\eta_0)(1 - \eta) + a_1(1 - \eta)(\eta_0 - \eta)\exp(a_2\eta)/(a_2\eta)^m \end{aligned} \quad (11)$$

where $u_{us}(\eta)$ is the flow velocity generated by a barge-tow moving upstream. For a downstream-bound barge, the velocity profile will be negative, i.e., $u_{ds}(\eta) = -u_{us}(\eta)$ where $u_{ds}(\eta)$ is the flow velocity generated by the downstream-moving barge-tow. Therefore, it can be stated that the lateral flow velocity distribution between the barge and the shoreline is a combination of shear flow in subchannel 3 or 2 and parallel flow (return flow) in subchannel 4 or 1 (see figure XXX-1).



XXX-5. Variations of m for upstream and downstream bound barges

APPENDIX XXXI.

**TECHNICAL PAPERS PUBLISHED BY WATER SURVEY RESEARCHERS
IN REFEREED JOURNALS**

TURBULENCE IN RIVERS DUE TO NAVIGATION TRAFFIC^a

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ABSTRACT: This paper presents the research results of statistical parameters associated with turbulence in a natural river caused by the movement of navigation traffic. Movement of navigation traffic within restricted inland waterways, such as the Illinois, Mississippi, or Ohio Rivers, changes their flow characteristics temporarily in space and time. These spatial and temporal changes must be quantified in order to assess their effects on biologically sensitive areas, and they have seldom been evaluated for natural waterways. Data are collected from the Illinois River to evaluate these changes. The longitudinal and lateral components of fluctuating velocity (u' , v'), Reynolds stress ($-\rho u'v'$), turbulent intensities (σ_u , σ_v), turbulent kinetic energy (TKE), and maximum return velocity generated by navigation traffic are analyzed here. Results have shown that significant changes occur in all of these parameters. The largest changes take place in a zone within 10% of the channel width from the shore.

INTRODUCTION

Movement of barge traffic in a restricted waterway is associated with physical changes in flow parameters limited in space and time. A thorough understanding of navigation impacts on riverine habitats requires a thorough understanding of these physical processes. Field data have been collected and analyzed to determine changes in velocity structures in the channel border areas due to commercial navigation on the Upper Mississippi River System (UMRS).

Physical changes associated with barge-tow movement can be explained schematically, as shown in Fig. 1 [after Blaauw et al. (1984); Bhowmik and Mazumder (1990)]. These physical changes include return flow, waves, drawdown, and screw wash. If the barge tow moves in stagnant surroundings, the wave pattern will move with the barge, as shown in Fig. 1 by the front wave at (A). Due to the movement of the barge, flow velocity beside the barge will accelerate in the opposite direction (return current), and the water level will drop within the channel to maintain the continuity of flow, as shown by drawdown (B) or water-level depression. The resulting velocity structure is composed of two parts: barge-induced displacement velocities and tow-induced propeller jet velocities. The turbulent jet flow behind the vessel is generated through the direct action of the propellers, its velocity distribution is normally assumed to be symmetrical around the axis of the

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A basic explanation of physical changes due to navigation was presented as a technical paper at the 1990 *National Conference on Hydraulic Engineering* (Bhowmik and Mazumder 1990). Some results on turbulence and Reynolds stress associated with navigation traffic were presented at the 1991 *National Conference on Hydraulic Engineering* (Mazumder et al. 1991).

Many researchers, such as Raichlen (1967), McQuivey and Richardson (1969), Nakagawa and Nezu (1981), and Nezu and Rodi (1986), have conducted experiments to determine mean flow and turbulent characteristics in open-channel flow. Recently, the laser doppler anemometer has been used for advanced investigations of turbulent structures in compound channels (Knight and Shiono 1990) and in submerged hydraulic jumps (Long et al. 1990) in laboratory settings. However, no detailed investigation has been performed with an array of 2-D current meters in a riverine environment other than the present research conducted by the Illinois State Water Survey (ISWS).

INSTRUMENTATION AND FIELD DATA COLLECTION

Data were collected from two sites on the Illinois River. The first site is near McEver's Island at river mile (RM) 50.1 (80.2 km). The second site is near Kampsville at RM 35.4 (56.6 km) River miles on the Illinois River start from the confluence of the Illinois and Mississippi Rivers. Cross-section profiles for these two sites with the instrument configuration are shown in Fig. 2. Both cross sections are trapezoidal, but the McEver's Island site was approximately 100 m narrower than the Kampsville site.

Fig. 2 also shows the coordinate system used for this research. It should be noted that the data from McEver's Island were collected on the left-descending bank (LDB) of the river while data from the Kampsville site

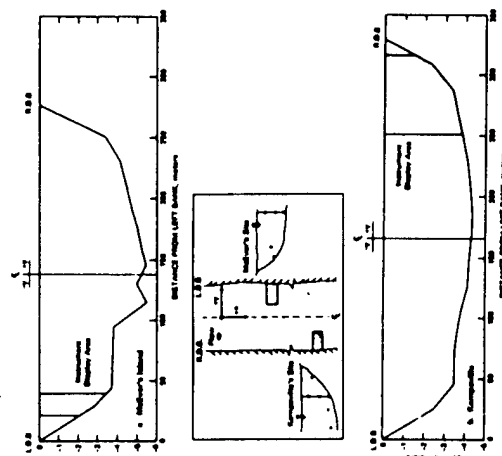


FIG. 2. Definition Sketch of Coordinate System and Cross-Sectional Profiles of Two Sites

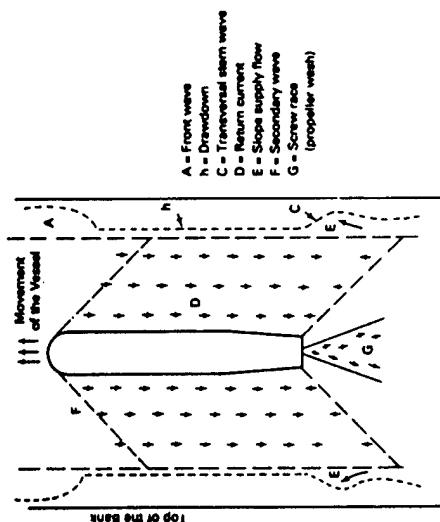


FIG. 1. Schematic Design Showing Water Motion Generated by Moving Ship in Stagnant Water (after Blaauw et al. 1984)

propeller, similar to a three-dimensional jet flow. The schematic diagram in Fig. 1 represents ideal conditions only. In a real waterway, the return flow patterns are not parallel to the vessel or the shoreline, and a complex flow pattern is generated. The present research addresses some of these phenomena.

Previous investigations on traffic effects in restricted waterways were mostly concentrated on return flows, drawdown, waves, and propeller jet velocities. Several methods have been developed by researchers such as Schijf and Jansen (1953), Tothill (1966), Sharp and Fenton (1968), and Bouwmeester (1977) to compute drawdown and return flows beside the barge on the basis of conservation of mass, momentum, and/or energy. Empirical formulas to compute return flows beside the barge have been developed by Fuehrer and Romisch (1977), Simons et al. (1981), Berger et al. (1981), and Hochstein and Adams (1989). Blaauw and van der Knaap (1983) reviewed methods for computing the drawdown and average return flow. Tow-induced propeller jet velocities were computed through an analogy with a turbulent jet with a symmetrical Gaussian distribution from the axis of the propeller (Blaauw and van de Kaa 1978; Verhey 1983).

However, other parameters, such as turbulent characteristics due to barge traffic, have been elusive because of lack of data. And previous studies emphasized canal systems, so the basic assumptions must be re-examined to apply to a large natural river. The main objective of this paper is to analyze the turbulent characteristics of flows induced by barge traffic in a natural river. Turbulent characteristics in large rivers due to the movement of the barge traffic are fundamental to the study of sediment resuspension and the effects, if any, of these changed physical processes on aquatic habitats. Parameters analyzed included the cross-sectional and vertical distribution of return velocity, turbulent Reynolds stress, $(-\rho u'v')$; turbulence intensities (σ_u, σ_v) ; and turbulent kinetic energy (TKE). These parameters are compared for both background conditions and barge passage conditions.

Flow in a large river is essentially one-directional (with three-dimensional resolution) with fluctuating components in the lateral and vertical directions. At the initiation of the present project, the ISWS researchers discussed the applicability of Marsh-McBirney meters and the frequency of sampling with others working on the Mississippi and Ohio River systems: Ken Lubinski, U.S. Fish and Wildlife Service; Drew Miller, Waterways Experiment Station, who is also collecting data from the Mississippi River; and Terry Siemsen, U.S. Army Corps of Engineers, Louisville District, who is collecting data from the Ohio River. It was collectively decided that Marsh-McBirney meters were probably among the most rugged commercial meters available for river environments with continuous flows of drifting debris. Moreover, a frequency of one sample per second provides an excellent resolution of the fluctuating components of the velocities. At present, all the researchers mentioned previously are sampling at a frequency of one sample per second. Marsh-McBirney meters were also used by Demissie et al. (1986) to collect secondary circulation data from natural rivers and by hydrologists from Environmental Science and Engineering, Inc. ("Navigation Impact" 1981), to collect data on turbulent fluctuations of velocities from the Illinois River.

ANALYSIS OF VELOCITY DATA

Changes in velocity during barge passage are the combined result of the ambient velocity, return flow, and the propulsive jets of the tow. Because of the return flow, the velocity vector changes temporarily with space and time in the zone between the barge and the shoreline. Apparently the velocity vector and the duration of return flow depend on the barge-tow characteristics. It is imperative to understand the changes in return flows with time and space from the barge to the shoreline.

Two components of velocity were measured at different locations between the shore and the barge. An example of typical resultant velocity is presented in Fig. 3, which demonstrates velocity vectors for 30-min periods at three different locations for a single barge-tow convoy with a draft of 2.74 m moving downstream at a speed of 2.3 m/s. The barge-tow convoy was 180 m from the LDB. This very interesting example is typical of what was observed at other locations.

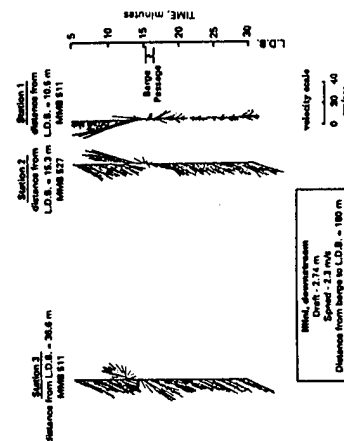


FIG. 3. Resultant Velocity Vectors during Downstream Barge Passage

585

were collected on the right-descending bank (RDB). The x-axis is along the main stem of the river, positive in the downstream direction. The y-axis is perpendicular to the x-axis and positive toward the LDB of the river. The z-axis is normal and upward from the xy plane. Thus, two sets of data were collected from two separate sides of the river at two different cross sections. Because of these differences, notations on various figures along the y-axis (to be discussed later) may show plus (McEver's Island) or minus (Kampsville), depending on the location of the survey.

Velocity data were collected using a set of two-dimensional (2-D) electromagnetic current meters installed along a cross section from the shore to the sailing line, manufactured by Marsh-McBirney, Inc. (MMB). The water-velocity sensor is based on the Faraday principle of electromagnetic induction, where a conductor, such as water moving in a magnetic field, produces a voltage that is proportional to the velocity of the water. The ISWS used two different types of meters in the field experiment, MMB 511 and MMB 527. At the McEver's Island site, four MMB 511s and one MMB 527 were used. At the Kampsville site, they used four MMB 511s and two MMB 527s. The accuracy of these meters and their basic capabilities are given in Table 1. Further information can be obtained from the user's manual (Instruction Manual 1991).

The data collection scheme focused on information closer to the channel bed as well as on lateral variations. Therefore, the current meters were installed about 1 m above the bottom and aligned in a transect. However, the vertical distributions of the u and v components were also measured at one station at each site (Fig. 2). The lateral distances from the LDB for the McEver's Island site were 10.5, 15.3, and 36.6 m. At 36.6 m from the LDB, three MMB 511s were arranged to measure the vertical distributions of horizontal velocities. The height of the probes was 0.15, 0.92, and 1.9 m above the bed. The depth of water at this vertical point was 3 m.

Data from the Kampsville site were collected at four stations near the RDB. The lateral distances from the RDB were 13.0, 33.6, 47.3, and 65.6 m. At 33.6 m from the RDB, a vertical array of three MMB 511s heights were 0.20, 1.22, and 2.44 m from the bottom. The total water depth at this vertical point was 3 m. The sampling rate at both sites was one sample per second, regardless of barge passage. This resolution has been proved sufficient for determining overall velocity changes and turbulent characteristics within a large river such as the Illinois.

It should be understood that in a laboratory setting, data on turbulent fluctuations of velocities could be collected at 0.3–0.1-s intervals. In a project on velocity fluctuations in oceanic environment, Soulsby (1980) discussed a relationship that may exist between sampling rates, size of sensors, and response time. He also suggested a relationship between these variables that may be valid for oceanic environments.

TABLE 1. Specifications of Current Meters

Instrument (1)	Parameters (2)	Range (3)	Accuracy (4)	Probe diameter (cm) (5)
MMB 527	u, v Direction	± 300 cm/s 0–360°	± 2% of reading ± 10°	10.3
MMB 511	u, v	300 cm/s	± 2% of reading	3.9

Note: u and v are velocity components in x- and y-direction, respectively.

584

Analyses such as this show the overall changes in velocity over one-half the width of the river (116 m wide at this location). Each line in Fig. 3 is a vector plot indicating the magnitude of resultant velocity averaged over 15-s intervals and its directional changes due to barge passage. This figure clearly shows that with the downstream movement of the barge, the flow moves towards the bank, and then rotates counterclockwise to an upstream direction. The rotation of flow is visible for the MMB 527 and 511 meters located 15.3 and 36.6 m, respectively, from the LDB. For the meter located 10.5 m from the LDB, even though the rotation is visible, the flow direction more or less goes back and forth in the downstream direction after the passage of the barge-tow convoy. Being close to the shoreline, this meter was obviously affected by the breaking waves in this shallow area.

For upstream barge movement, the flow initially moved toward the sailing line and then rotated counterclockwise to the downstream direction. Data collected from other events have shown similar patterns, with the magnitudes of the velocity vectors changing the speed, direction, and river flow characteristics of the test area.

Temporal Variations of Velocities and Reynolds Stress

Analyses of the temporal variations of the velocities and Reynolds stress are described briefly in this section. Velocity measured during a 10–15-min period just before the barge passage is called “background velocity,” and the disturbances created due to the barge passage in the cross section are called the “event.” The flow characteristics of background velocity, and their direct comparisons with net velocity changes due to the event that involves removing the mean background velocity, are discussed for three different lateral distances from the shore. This includes evaluation of the longitudinal and lateral velocity components and the turbulent shear stress at particular points between the barge and the shoreline.

Denoting the time-averaged x component of velocity by u and its fluctuation by u' , the following relations for three velocity components (u , v , w) can be written as

$$u = \bar{u} + u', \quad v = \bar{v} + v', \quad w = \bar{w} + w' \quad \dots \dots \dots (1)$$

The time-averaged velocities at a fixed point in space are given by

$$\bar{q} = \frac{1}{T} \int_0^T q \, dt, \quad \text{where } q = (u, v, w) \quad \dots \dots \dots (2)$$

where T = duration of the background velocity or event; and the time-averages of all fluctuating components equal zero. Fig. 4 shows the periodic variation of turbulent fluctuating velocity components (u' , v') and the shear stress ($-\rho u'v'$) at a point 10.5 m from the shore when barge moves downstream at the McEver's Island site shown in Fig. 2(a). The x component of return flow beside the barge changes significantly for both upstream and downstream traffic and increases in magnitudes by 0.2–0.6 m/s. This increase in velocity can last for 4–8 min and even 15 min near the shore before ambient flow conditions return. This longer time needed for the nearshore station to reach ambient flow conditions is a result of: (1) Chaotic water motion near the shoreline due to the irregular boundary; (2) amplified drawdown and waves in shallower water; and (3) the effects of the refraction and diffraction of waves. This complex velocity behavior near the irregular boundary may also be due to the combined efforts of bowpush and propeller

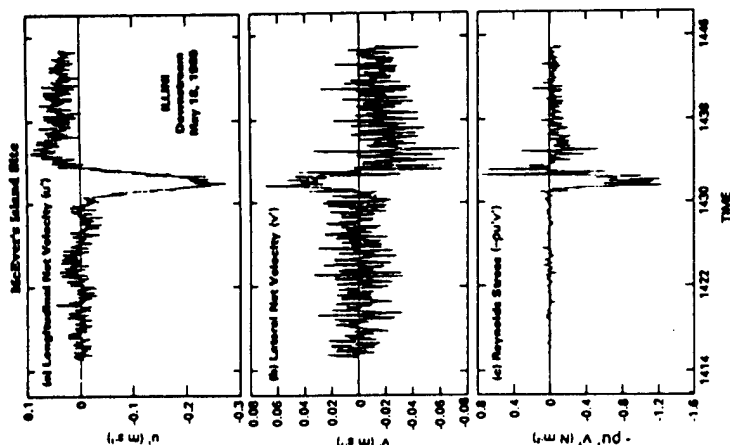


FIG. 4. Temporal Variations of Turbulent Fluctuating Velocities and Reynolds Stress for Downstream Barge

jet behind the barge tow. The lateral velocity (y component) increases, then decreases and becomes negative before reaching a stationary state. This indicates that for the downstream barge, fluid initially moves toward the shore and then back toward the sailing line [Fig. 4(b)]. The reverse seems to happen for upstream-bound events. The x component of the return flow can last longer than the y component beside the barge. The maximum velocity changes due to navigational traffic at this location can be as much as three to ten times the background mean velocity. The maximum velocities, durations of events, and turbulent shear stress generated by the barge movement mainly depend on barge dimension, river cross section, tow speed, draft, and the distance of the barge from the shoreline.

Cross-Sectional and Vertical Velocity Distributions

When the barge moves upstream, the natural flow condition is superimposed by the downstream components of return flow beside the barge, which result in increased velocity between the barge and the shore. When the barge moves downstream, the return flow beside the barge moves in the opposite direction to the ambient flow, and the overall velocity becomes zero near the midpoint between the barge and the shoreline and negative

near the shore. The fluid velocity at the boundary of the barge is assumed to be equivalent to the barge speed. At increasing distance from the barge, the fluid velocity decreases; that is, the dragging action exerted on the fluid particles farther from the barge gradually decays. Fig. 5 shows the cross-sectional variation of the longitudinal component of maximum net return flow velocity (removing the background mean) for a set of upstream and downstream events. These changes have been plotted against one-half the width of the river $y/(W/2)$ in one cross section. The return flow increases in the positive or negative directions due to the respective upstream and downstream movement of the barges. The effects of return flow for both cases are prominent, especially near the shore, creating higher turbulent shear and larger eddies. Fig. 5 also shows that velocity increases significantly at a point about 20% of the distance to the middle of the river (10% of the total width) and then decreases to zero at the midpoint between the shore and the boundary of the barge. The velocity distribution is parabolic in this zone. Because velocity data were not collected beyond this, they could not be presented in this figure.

The vertical distribution of mean background velocities (u , v) and the maximum return velocities due to the movement of navigational traffic were also analyzed for various barge configurations at a site on the Illinois River near Kampsville (the vertical station at the McEver's Island site had one meter malfunction). Velocity data were collected at three different heights (z), 0.20, 1.22, and 2.44 m above the bed. The depth of water at this location was 3.0 m. The current meters were located at a distance of 33.6 m from the shore, which was about 15% of one-half of the width of the river from the RDB. Data for two barge events, one moving upstream and another moving downstream, are presented in Fig. 6. For both events and background conditions, the figure shows that the vertical velocity distributions remained nonlinear and probably follow the logarithmic law. Moreover, the increasing velocities of the barge tow *Conti Karla*, moving upstream, remained fairly constant at all three levels. The magnitude of the increase was about 100%. This shows that in longitudinal velocities changes at all levels due to the movement of barge traffic, and that the increases in velocities

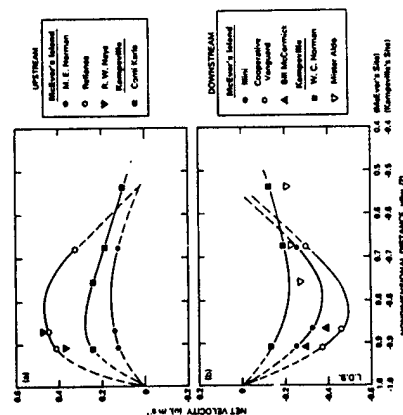


FIG. 5. Net Longitudinal Velocity Distributions due to Movement of Navigation Traffic

588

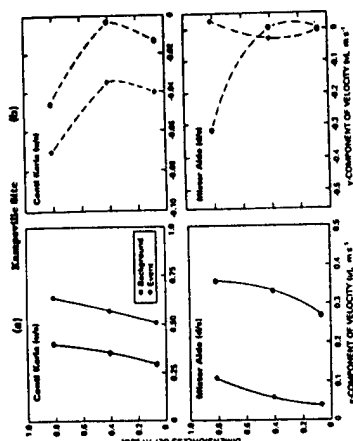


FIG. 6. Variations of Velocity with Depth before and during Upstream and Downstream Barge Movements; (a) Longitudinal Velocity; and (b) Transverse Velocity at the Kampsville Site

are fairly uniform. On the other hand, when the barge tow *Mister Aldo* was moving downstream, the return flow essentially decreased the main flow velocity from about 0.28 m/s near the bed to 0.03 m/s. At an elevation of 2.44 m above the bed, the velocity decreased from about 0.37 to 0.11 m/s. These changes in ambient velocities due to barge movement are quite dramatic and follow the basic concept that the return flow moves in the opposite direction of the barge.

Fig. 6(b) shows the variations in the lateral (y) component of the velocity for both barge tows, the *Conti Karla* and the *Mister Aldo*. For the *Conti Karla*, which was moving upstream, the lateral velocity increases at all levels in the vertical, indicating that the water moved toward the shore. The absolute magnitude of these velocity differences is approximately 0.02 m/s at all elevations. Note that the negative sign in the velocity scale indicates that flow is toward the shore.

The changes in the lateral velocities observed for the upstream movement of the barges at the Kampsville and McEver's Island sites are similar. A comparison of Fig. 6(b) (the *Conti Karla*) with similar data from the McEver's Island site has shown that at an equivalent distance from the shore and for both sites, upstream barge movement causes water to move laterally, essentially toward the shoreline. Thus, the actual behavior of the water movement is similar at both sites and at fixed distances from the shore or the centerline. This is extremely important, showing that the physical changes associated with the movement of barge traffic in large rivers are essentially similar, even though the absolute magnitudes of these changes may change for different river configurations.

Fig. 6(b) also shows the plot of transverse velocity changes in the vertical for the barge-tow configuration *Mister Aldo* moving downstream. Even at elevations of 0.2 and 1.22 m above the bed, no significant alterations in velocities occurred. But at an elevation of 2.44 m above the bed ($z/D = 0.8$), the magnitude of velocity decreases from about 0.32 m/s to zero. This indicates that for downstream barge movement, the transverse component of the velocity at a distance of about 15% of the half-width of the channel is essentially toward the centerline of the channel. This is exactly what was

589

observed for the barge tow *Illini* at the McEver's Island site at an equivalent distance from the shore.

The similarity in the altered velocity structures between the two sites, one 232 m wide (McEver's Island) and the other 330 m wide (Kampsville) indicates that the data and the subsequent analysis performed for each site may be transferred to other sites where field data are not available.

The cross-sectional variation of transverse fluctuating velocity v' generated by the upstream and downstream barges has also been analyzed. For the upstream barge, transverse velocity v' decreases near the shore, indicating the movement of fluid toward the sailing line. Then it increases at a distance of 15% of the half-width from the shore due to the fluid movement toward the shore. Again, for the downstream barge, the transverse velocity

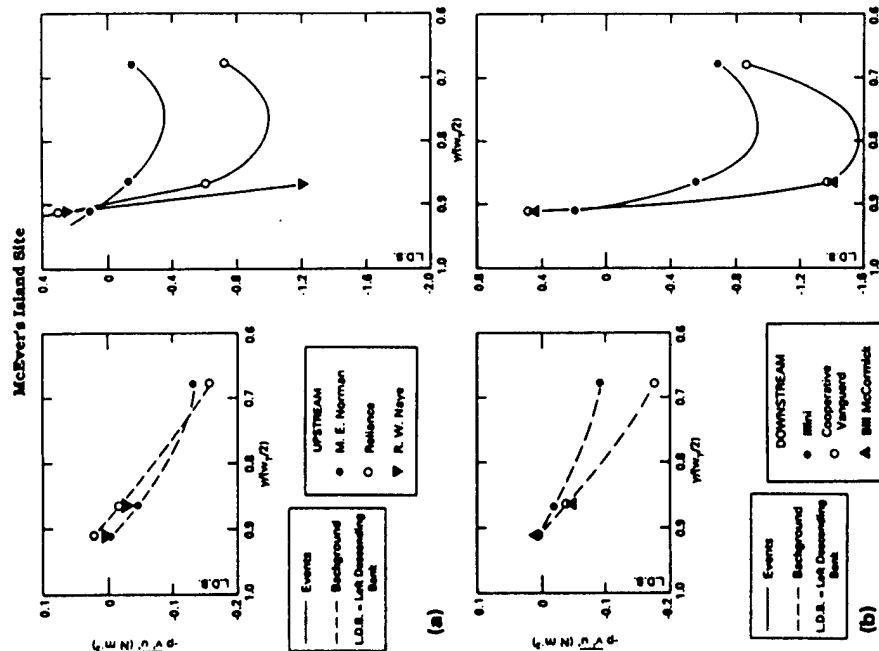


FIG. 7. Lateral Reynolds Stress Distributions before and during Series of Events at McEver's Island Site

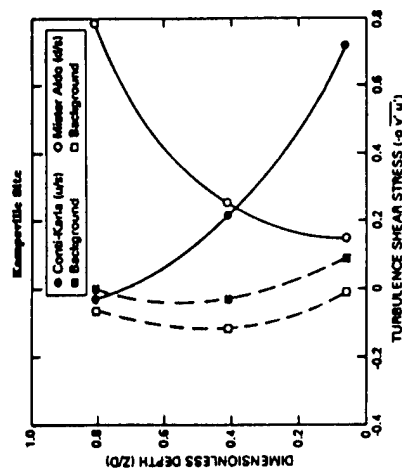


FIG. 8. Vertical Variations of Reynolds Stress for Longitudinal Component of Velocity: Background and Events

(v') increases near the shore and then decreases, which means that water moves toward both the shore and sailing line. Therefore, at a particular instant, fluid can be stretched toward the shore and toward the sailing line due to the movement of barge traffic.

Reynolds Stress Distribution

Time-averaged Reynolds stress or turbulence shear stress is defined by

$$\tau_{xy} = -\rho \overline{u'v'} = -\rho \frac{1}{T} \int_0^T u'v' dt \quad (3)$$

which can be interpreted as the transport of x momentum through a surface normal to the y -axis. Fig. 7 shows the variation of turbulent shear stress distributions ($-\rho \overline{u'v'}$) averaged over the duration 10–15 min before the barge passage and over the duration of the disturbance (event) generated by each barge against one-half of the river's cross section $y/(W/2)$ for three upstream- and three downstream-bound barges. The Reynolds stress distribution averaged over the duration of the background velocity varies approximately linearly with the distance from the shore, whereas during the events it varies nonlinearly with distance from the shore. The qualitative behavior of Reynolds stress distribution can be compared with distributions measured in closed channels or in wind tunnels (Schlichting 1966; Hinze 1975). There is also a close similarity with the corresponding results obtained in boundary layer flow. The correlation coefficient, ψ , between the longitudinal and transverse fluctuation at the same point can be defined as [Schlichting (1966) page 533]

$$\psi = \frac{\overline{u'v'}}{\sqrt{\overline{u'^2} \sqrt{\overline{v'^2}}}} \quad (4)$$

The existence of an apparent shearing stress due to velocity fluctuations always implies a correlation between the turbulent velocity components in two different directions. Fig. 7 shows that the turbulent shear stress reaches

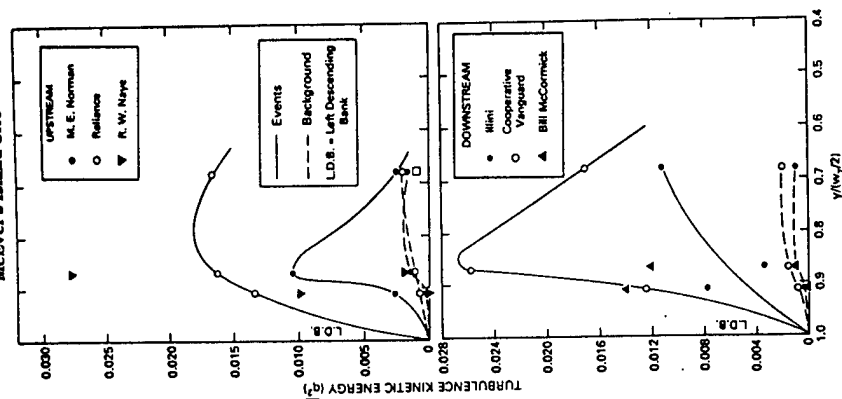


FIG. 10. Lateral Variations of Turbulent Kinetic Energy for Upstream and Downstream Events: Background and Events

Turbulence Intensities

The intensity of turbulence or standard deviation σ_z and σ_y , and the relative intensity of turbulence, σ_z/u and σ_y/v , were also computed and analyzed. The distributions of σ_z for both background velocity and barge event have been plotted in Fig. 9 against one-half width of the cross section of the river for six different barges moving upstream and downstream. The distribution of longitudinal turbulence intensity for both upstream- and downstream-bound barges is similar, whereas the distribution of transverse turbulence intensity for the upstream and downstream barges is somewhat different. The intensities of the two turbulence velocities, one for the event and the other for the background, differ appreciably from one another over the half-width of the river. Between 0.8 and 0.9 of $y/(w_r/2)$, the differences are substantial. However, the differences appear to decrease as one moves

593

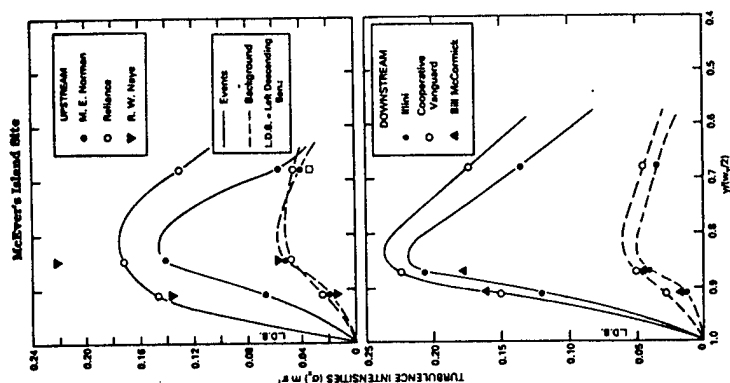


FIG. 9. Lateral Variations of Turbulence Intensities for Upstream and Downstream Barge Movement: Background and Events

to maximum value at $y/(w_r/2) \approx 0.8$ and then decreases to almost zero in the central zone between the bank and the barge where the turbulent fluctuations decay. The maximum Reynolds stress generated by the movement of navigational traffic is as much as ten times larger than the background velocity. And the movement of barge traffic in a river appears to generate larger eddies and more transverse turbulence shear than the background flows. As there is a linear variation in Reynolds stress for the background velocity, the transfer of energy takes place from the higher shear zone to the lower one.

Fig. 8 shows the vertical variations of the time-averaged Reynolds stress $(-\rho u'v')$ for the background velocity and two events, one upstream and one downstream barge movement of the Kampsville site. For the upstream barge, the turbulence shear stress is large near the bed and decreases to zero toward the water surface, which is consistent with the increment of depth (z/D) , shown in Fig. 6. At the same time, for the downstream barge, the turbulence shear stress increases toward the surface, which is also consistent with the vertical variation of velocity due to barge events, as shown in Fig. 6.

592

either toward the shore or away from it from this range. The intensity of the longitudinal turbulent velocity component has a higher value than the transverse component, which is comparable to the closed-channel flow or the turbulent boundary layer near the wall (Hinze 1975).

An analysis of the variations of σ_x and σ_y with depth for background velocities and for events (the two upstream and downstream barges shown in Figs. 6 and 8) has shown that the turbulence intensities in both directions due to the movement of barges are higher than the background velocities for both upstream and downstream barges. The x component of turbulence intensities throughout the depth generated by the navigational traffic is as much as four times higher than the background velocity, which is almost uniform with depth.

Turbulent Kinetic Energy

Turbulent kinetic energy (TKE) per unit mass is defined by

$$TKE = \frac{u'^2 + v'^2}{2} \dots\dots\dots (5)$$

The TKE distribution generated by the velocity changes across the half-width of the river $y(W/2)$ has been plotted in Fig. 10 for various upstream and downstream events. The TKE distribution for the background velocity averaged over 10–15 min before the barges passages is also shown. These variations in TKE are similar to those shown for the turbulence intensity. TKE increases, reaches a maximum value around 0.8–0.9 of $y(W/2)$, and then decreases. It shows that the maximum TKE gathered by the velocity changes due to the barge passage is significantly higher than that for the background velocity. Thus, at a distance of 10–20% of the half-width of the channel from the shore, the TKE becomes highest for both the upstream and downstream barge events.

The analysis presented so far for the velocity and Reynolds stress distributions, including the turbulence intensities and TKE, indicates a significant difference in a large river before and during an event associated with the movement of barge traffic. The critical zone where changes in velocities, turbulence, and TKE occur is at a point about 10–20% of the distance from the shoreline to the half-width of the channel. Additional data collected by ISWS researchers are being analyzed now to quantify these changes and to develop methods for estimating these variations.

CONCLUSIONS

The movement of barge traffic in a restricted waterway such as the Illinois, Mississippi, or Ohio Rivers can change the velocity structure within the main channel and the channel border area. The changes of velocity (both x and y components) can last for 4–8 min and even 15 min near the shoreline before ambient conditions return. The x component of return flow can last longer than the y component in general. The return flow changes significantly for both upstream and downstream barge movement, increasing in magnitudes (in absolute value) by 0.2–0.6 m/s. These changes occur mostly within a zone of about 10% of the width of the river from the shoreline. The maximum velocity changes due to navigation can be as much as three to ten times the mean background velocity. The effects of return flow for both upstream and downstream barge movements are prominent, especially near the shore where higher turbulent shear and larger eddies are created.

An examination of vertical velocity distributions shows that the increased and decreased velocities for upstream and downstream barge movements, respectively, are quite measurable at all levels from the bed. The changes in velocities observed in the lateral direction for upstream and downstream barge movements at Kampsville are similar to those observed at McEver's Island.

The maximum turbulence shear stress generated by barge movement at a dimensionless distance of about 0.8–0.9 from the centerline of the channel is as much as 10 times higher than that averaged over the duration of background velocity. The movement of barge traffic in a river can generate larger eddies and more transverse shear than can natural flows in the river.

The qualitative behavior of axial turbulence intensity distribution for both upstream and downstream barges movements is similar, whereas the behavior of the transverse turbulence intensity is somewhat different. The intensity of the axial turbulence velocity component has a higher value than the transverse component. This is quite comparable to the turbulent boundary layer near the wall in a closed channel. In fact, the turbulence intensities following events in both axial and transverse directions are as much as four times higher than the background turbulence intensities.

The TKE generated by the event increases, reaches a maximum value between 0.8 and 0.9 of $y(W/2)$, and then decreases. This shows that the maximum TKE produced by the velocity changes is significantly higher than the background TKE in the natural river.

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This research was done as a part of a project supported by the U.S. Army Corps of Engineers through the Environmental Management Program for the Upper Mississippi River System. Funding was provided through the Environmental Management Technical Center, Onalaska, Wisconsin. Ken Lubinski was the project manager. Many Water Survey staff assisted in the data collection and analysis of data: Rodger Adams, Bill Bogner, Jim Słowikowski, and Ed Delisio. The writers also thank the three reviewers for their excellent comments and suggestions.

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APPENDIX II. NOTATION

The following symbols are used in this paper:

- D = local depth of river;
 g = acceleration due to gravity;
 h = water-level depression/drawdown;
 q = velocity vector, $q = (u, v, w)$;
 T = duration of time period;
 t = time;
 u, v, w = velocity components;
 u', v', w' = fluctuating velocity components;

596

- $\bar{u}, \bar{v}, \bar{w}$ = time averaged velocities;
 W_r = width of river;
 x = axial coordinate;
 y = lateral coordinate;
 z = vertical coordinate;
 ρ = density of water;
 $-\rho u'v'$ = turbulent shear stress;
 σ_x, σ_y = turbulence intensities (x and y components); and
 τ_{xy} = turbulent shear stress.

597

RETURN FLOW IN RIVERS DUE TO NAVIGATION TRAFFIC

By Nani G. Bhowmik,¹ Fellow, ASCE, Renjie Xia,² Associate Member, ASCE, Bijoy S. Mazumder,³ and Ta Wei Soong,⁴ Member, ASCE

INTRODUCTION

Movement of navigation traffic (barges-tows) in restricted waterways such as the Illinois or Mississippi Rivers can generate rapid return flow and water-level depression (drawdown) between the barge and the shoreline. Consequently, the velocity distribution in the zone between the barge and the shoreline changes temporarily in space and time. Many investigators have developed methods to compute the return velocity based on the concept of one-dimensional conservation of mass, momentum, or energy. Some investigators have also discussed methods of computing the return-velocity distribution across the channel between the barge and the shoreline. All the methods predict an exponential velocity distribution that decreases laterally with distance from the barge. However, from the field data, it has been observed that existing models do not exactly represent field conditions. The objective of the present study is to use existing models to compute the average return flow and the lateral return flow distribution, and compare them with the observed data to test the validity of these models.

RETURN FLOWS

Schijf and Jansen (1953) and Tothill (1966) developed the following equations to predict average return flow in connection with the movement of barge traffic in a narrow channel with a rectangular or trapezoidal cross section based on the conservation of energy and mass:

$$2gh = (u_r + u_{ar})^2 - u_r^2 \quad (1)$$

and

$$u_r A_r = (u_r + u_{ar})(A_r - A_m - W_T h) \quad (2)$$

where h = drawdown; u_r = barge speed; u_{ar} = average return velocity along the river flow direction; g = acceleration due to gravity; A_r = wetted cross-sectional channel area; A_m = average submerged cross-sectional area of the vessel; and W_T = top width of the channel

Sharp and Fenton (1968) and Bouwmeester (1977) developed methods to predict return flow beside the barge on the basis of one-dimensional momentum and continuity equations as

$$F_1 - F_2 - F_3 = \rho A_r (u_{ar} + \bar{U})(u_{ar} - \bar{U}) \quad (3)$$

and

$$A_r(u_{ar} + \bar{U}) = A_1(u_{ar} + u_{ar}) \quad (4)$$

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where u_{ar} = barge speed with respect to bank; \bar{U} = average ambient velocity; ρ = density of fluid; F_1 , F_2 , and F_3 = forces acting on a control volume of water; and $A_1 = W_T(D - h) - s(D^2 - h^2) - A_m$, where D = average water depth and s = slope of embankment expressed as tangent of bank inclination.

Blauuw and van der Knaap (1983) modified the Bouwmeester's method and developed the equations for the conservation of momentum and mass as

$$F_1 - F_2 - F_3 = \frac{\rho A_r (A_m + W_T h) u_r^2}{A_r - A_m - W_T h} \quad (5)$$

and

$$A_r u_r = A_r (u_r + u_{ar}) \quad (6)$$

where $A_r = A_r - A_m - W_T h$ is defined as the wetted cross-sectional area of the channel after drawdown minus area of midvessel section

Hochstein and Adams (1989) developed a method to directly compute average return flow u_{ar} as

$$u_{ar} = u_r \{[(a - 1)B + 1]^{1/(n-1)} - 1\} \quad (7)$$

where $a = [n/(n - 1)]^{2/3}$; and B = either $0.3e^{1/(n-1)}$ for $u_r/u_{cr} \leq 0.65$ or 1 for $0.65 < u_r/u_{cr} \leq 1$, where $n = A_r/A_m$ and u_{cr} = the so-called first critical velocity, given by Hochstein (1967)

RETURN FLOW DISTRIBUTIONS

Hochstein and Adams (1989) assumed that the shape of lateral return flow distribution from the barge to the shoreline is exponential and is expressed by

$$u_r(y) = k_1 e^{-k_2 y} \quad (8)$$

where y = distance measured from the barge; $k_1 = \alpha u_{ar} d$; and $k_2 = W_T/\alpha[1 - e^{-\alpha F(\alpha)}]$, where d = barge draft, $F(\alpha) = 0.42 + 0.5 \ln \alpha$, W_T = distance from the barge to the shoreline, α = either 1 or $W_T/b \leq 2.5$ or $0.114W_T/b + 0.715$ for $W_T/b > 2.5$, and b = beam width of barge.

Simons et al. (1981) used the one-dimensional velocity equation proposed by Hochstein (1967) to determine an exponential distribution of the return velocity from the barge to the shoreline as

$$u_r(y) = \alpha u_r (\sqrt{a} - 1) e^{-k(y)} \quad (9)$$

where $k(y) = 1 + \alpha^2 y e^{-\alpha F(\alpha)/W_T}$.

Berger et al. (1981) determined an exponential variation of the return velocity from the barge to the shoreline as

$$u_r(y) = u_{r,max} e^{-y/k_2} \quad (10)$$

where $u_{r,max}$ = average local maximum return velocity over the depth beside the barge recommended by Fuehrer and Römisch (1977).

More recently, Maynard and Siemsen (1991) developed an exponential equation to compute the cross-sectional return velocity distribution from the tow to the shoreline as

$$u_r(y) = u_{r,m} e^{C(y-b)/(W_T-h)} \quad (11)$$

where $C = 1.2[0.024(2A_{side}/A_m) - 0.266]$; and $u_{r,m} = u_{r,side}[0.024(2A_{side}/A_m) + 0.734]$, where A_{side} = cross-sectional area of the river from the centerline of the tow to the

shoreline, $u_{rside} = u_{ur}[0.36(A_c/2A_{side}) + 0.64]$, and u_{ur} = average return velocity computed by using Schijf and Jansen's (1953) equation.

FIELD DATA COLLECTION

Field data were collected from the Illinois River at river mile 35.2, near Kampsville. The average width of the river at this location is about 320 m during the data collection period. The river flow characteristics are presented in Table 1. Fig. 1 shows a schematic diagram of this site and relative locations of two-dimensional electromagnetic current meters (Marsh-McBirney, Inc., models MMB511 and MMB527) used to collect field data. The current meters were programmed to continuously measure x and y components of flow velocity at a rate of one sample per second. The x -axis is along the longitudinal direction of the river and positive in the downstream direction. The y -axis is perpendicular to the sailing line and positive toward the right bank of the river. Data from six upstream and five downstream bound barges (total of 11 events) were used in this study. Characteristics of these

TABLE 1. River Flow Characteristics

(1)	10/10/90 (2)	10/15/90 (3)	10/18/90 (4)
Q_w (m ³ /s)	413	772	817
\bar{U} (m/s)	0.36	0.58	0.61
D (m)	3.44	3.64	3.91

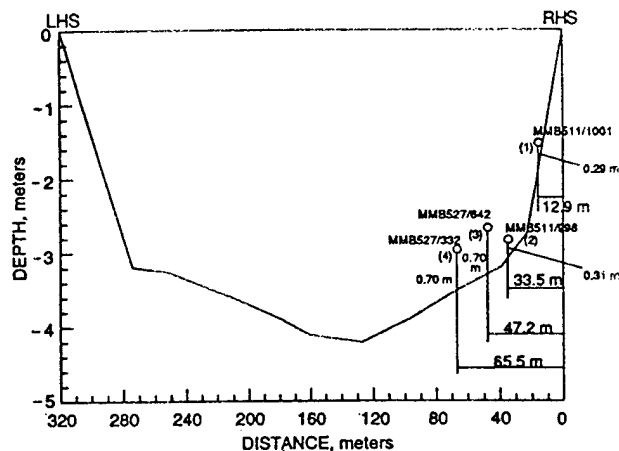


FIG. 1. Field Site on Illinois River at Kampsville and Relative Locations of Two-Dimensional Electromagnetic Current Meters

TABLE 2. General Barge-tow Information

Barge name (1)	Direction (2)	Configuration (3)	Speed (m/s) (4)	Draft (m) (5)	Distance from right bank (m) (6)
Sugarland	upstream	3 × 4	2.25	2.29	168
Conti Karla	upstream	3 × 5 + 1	2.05	2.35	143
Mr. Lawrence	upstream	3 × 5	2.92	1.74	168
Charles Lehman	upstream	3 × 4 + 1	2.20	2.74	143
Nicholas Duncan	upstream	3 × 3	1.89	2.74	130
Mr. Paul	upstream	3 × 5	2.81	1.62	130
Mr. Aldo	downstream	2 × 1 + 3 × 4	2.36	2.74	130
William C. Norman	downstream	3 × 4	2.54	2.74	137
Rambler	downstream	3 × 4	2.09	2.74	147
Ardyce Randall	downstream	3 × 5	1.96	2.74	143
Margaret O.	downstream	3 × 4	3.48	2.04	130

events are given in Table 2, in which vessel speed is relative to the streamflow.

VELOCITY ALTERATION

Mazumder et al. (1991, 1993) and Bhowmik and Xia (1993) discussed the turbulence characteristics of ambient velocity and compared them with those generated by barge-tow passage within the channel border area of a natural river. These analyses have shown that various turbulence parameters do increase and a return current in the direction opposite the barge motion is generated during barge-tow passages.

Figs. 2 and 3 show the temporal variations of turbulent fluctuating velocity components u' and v' , that is, return velocity components u_r and v_r , for an upstream (Nicholas Duncan) and a downstream bound barge (Mr. Aldo), respectively. An 11-point moving average technique was used to smooth out the fluctuations of the velocities. The selection of the 11-point moving average was done by experimenting with the data either to smooth out the fluctuations or to preserve the peak values of the velocities. The values of u_r and v_r can be determined by subtracting the ambient mean velocities \bar{u} and \bar{v} from the measured flow velocities u and v , respectively. The data shown in Figs. 2 and 3 are taken from a current meter installed 33.5 m from the shoreline at an elevation 0.31 m above the bed.

From Figs. 2 and 3, the effects of an event are either to increase the longitudinal return velocity u_r for upstream-bound barges or decrease it for downstream-bound barges. There is

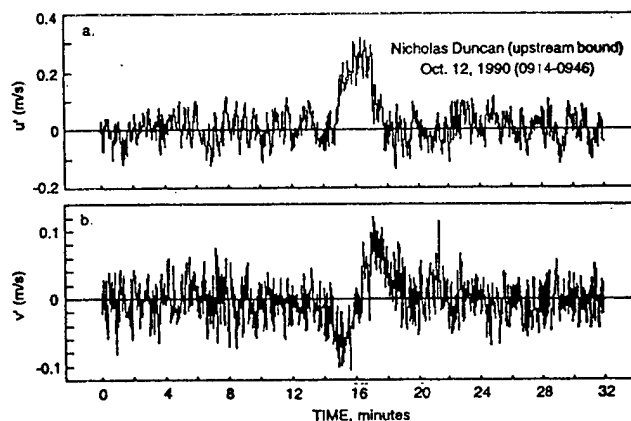


FIG. 2. Return Velocity Changes during Upstream Barge Movements: (a) Longitudinal; (b) Lateral

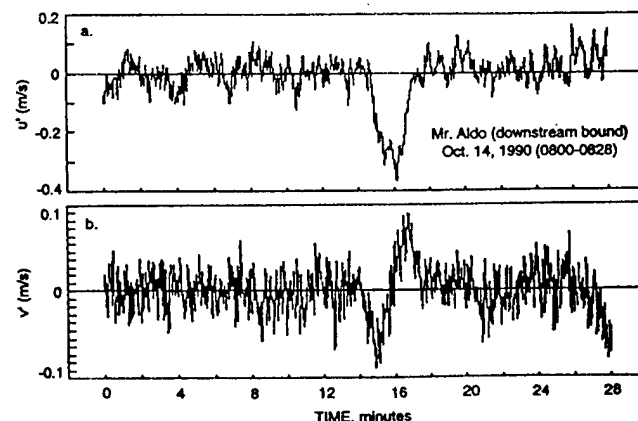


FIG. 3. Return Velocity Changes during Downstream Barge Movement: (a) Longitudinal; (b) Lateral

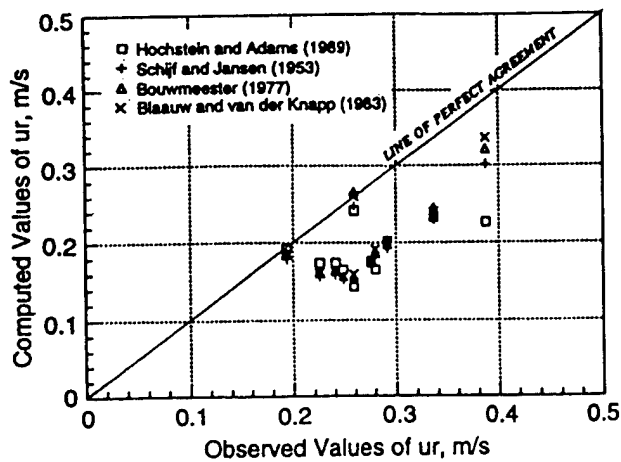


FIG. 4. Computed and Measured Values of Average Return Velocities

a maximum or minimum value of u_r for an upstream or downstream bound barge [see Figs. 2(a) and 3(a)], which actually reflects the maximum impact of the barge passage on the flow-velocity structure. Analysis of the lateral return velocity v_r shows the presence of a somewhat rotating flow field [see Figs. 2(b) and 3(b)]. This is because there is a change in the

direction of the lateral velocities during an event. This study only considers the u_r related to the maximum impact of the navigation traffic in order to compare the field data with the existing return flow models.

AVERAGE RETURN VELOCITY

Four existing models (Schijf and Jansen 1953; Bouwmeester 1977; Blauuw and van der Knaap 1983; and Hochstein and Adams 1989) can be used to predict the average return velocity. In this analysis, return velocities measured at all data collection locations at the Kampsville site on the Illinois River for each event were averaged to obtain an average return velocity within the width between the barge and the shoreline. These average return velocities for all 11 events were compared with the predicted average return velocities computed from the four existing models. These results then are shown in Fig. 4. Examination of this figure shows that all the methods proposed by the previous investigators tend to underestimate the average return velocity and this underestimation can reach up to about 30%.

LATERAL DISTRIBUTION OF RETURN VELOCITY

The variation of flow velocity from the barge to the river bank is also important for any study on the physical changes due to navigation traffic. The methods proposed by Simons et al. (1981), Berger et al. (1981), Hochstein and Adams

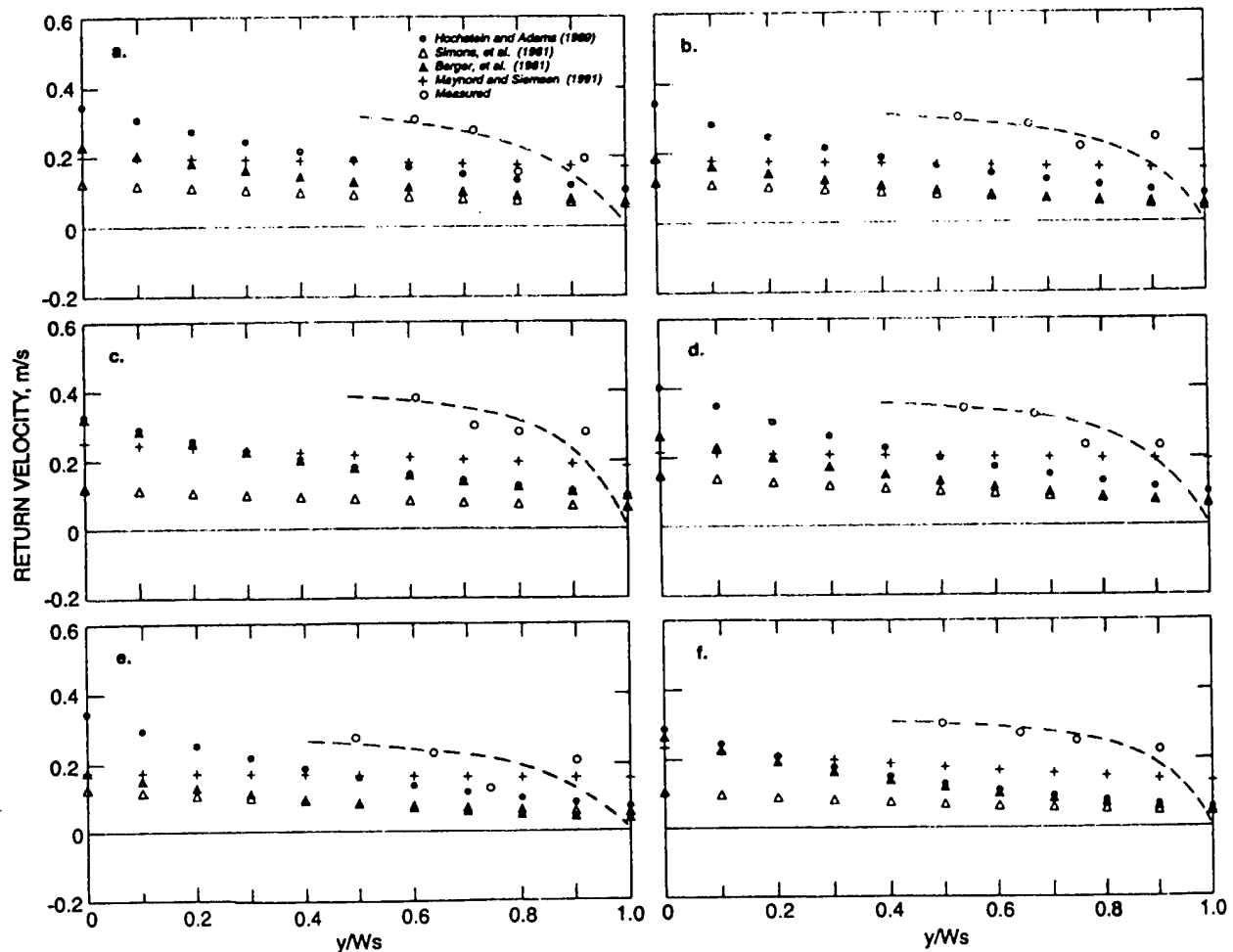


FIG. 5. Comparison between Computed and Measured Lateral Velocity Distribution for Upstream Bound Barges: (a) Sugarland; (b) Cont'l Karla; (c) Mr. Lawrence; (d) Charles Lehman; (e) Nicholas Duncan; (f) Mr. Paul

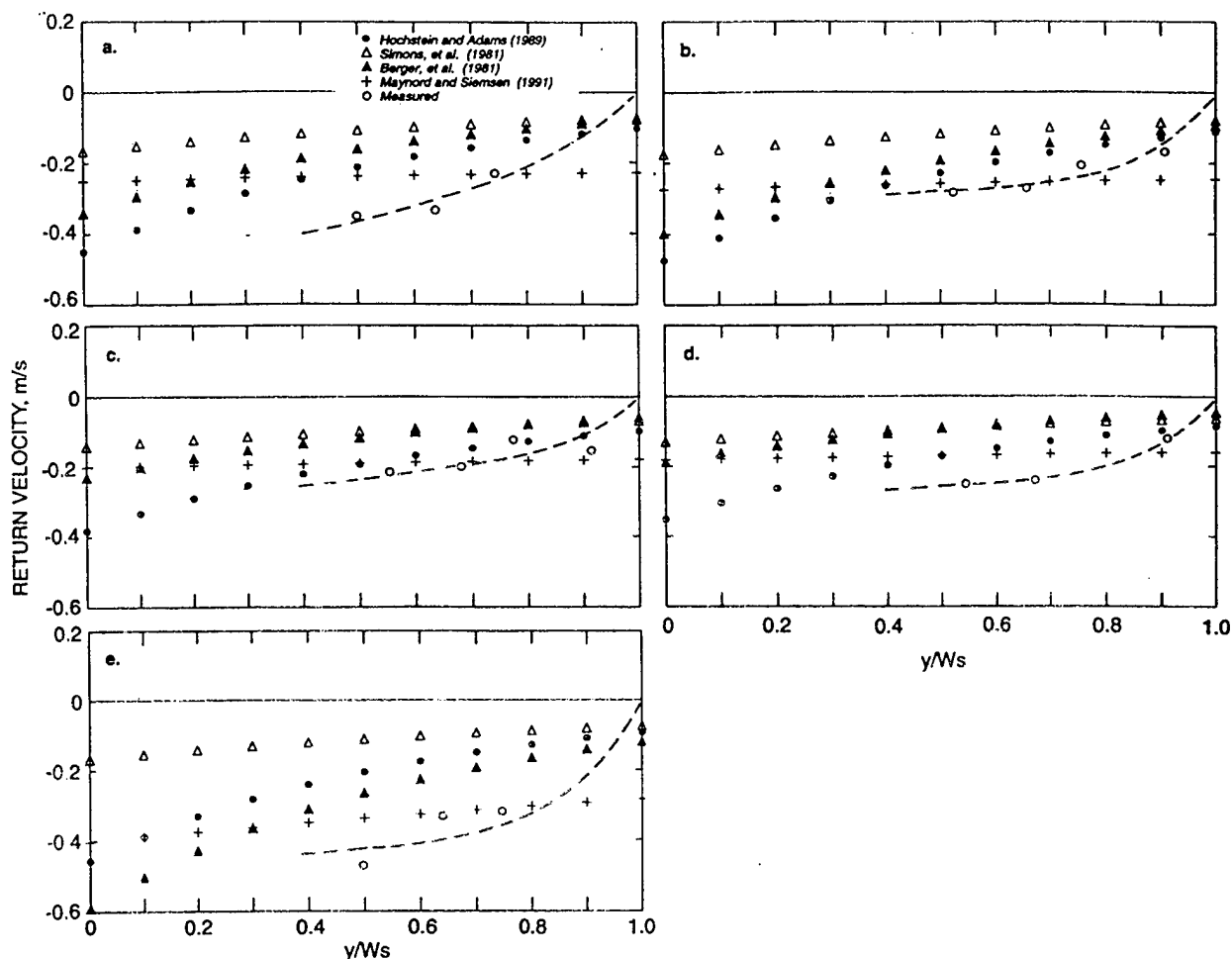


FIG. 6. Comparison between Computed and Measured Lateral Velocity Distribution for Downstream Bound Barges: (a) Mr. Aldo; (b) William C. Norman; (c) Rambler; (d) Ardyce Randall; (e) Margaret O

(1989), and Maynard and Siemsen (1991) can be used to determine the shape of the lateral return flow distribution. In all of these methods, predicted return velocity distributions decrease exponentially with distance from the barge to the shoreline. However, the field data collected from the Illinois River show a different lateral distribution of the return flow.

Figs. 5 and 6 show the predicted (dashed line) and measured lateral return velocity distributions for six upstream and five downstream bound barges. An examination of these plots for the 11 events shows that none of the existing models correlates well with the field data. For either the upstream or downstream bound barges, the return flow generated by barge-tows increases with distance from the shoreline and appears to have a parabolic-like distribution in the lateral direction. All the existing models underpredict the magnitude of the return velocities within the zone where velocity data were collected in the field for the present project.

CONCLUSIONS

Movement of navigation traffic in natural rivers is normally associated with a set of physical changes, including a return current and altered vertical and lateral velocity regimes. The changes of flow-velocity structure are important in the evaluation of sensitive biologist habitats within the channel border areas. Many investigators have developed methods to predict the return flow. However, a comparison of these methods

with field data shows that the existing models do not predict the return flow that well.

In this analysis, it was found that all the existing models underestimate the average return flow velocity by as much as 30%. It was also found that the exponential return flow distribution across the width between the barge and the shoreline described by the existing models are not supported by the field data. An examination of the field data indicates that the return flow due to the movement of navigation traffic may have a parabolic-like distribution. Therefore, it may be necessary to develop a more realistic model to predict the return flow in natural rivers due to the movement of navigation traffic.

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APPENDIX II. NOTATION

The following symbols are used in this paper:

- A_c = wetted cross-sectional channel area;
 A_m = average submerged cross-sectional area of vessel;
 A_{side} = cross-sectional area from tow centerline to shoreline;
 a = ratio of cross-sectional areas;
 B = empirical parameter;
 b = vessel beam;
 D = average depth of water;
 d = vessel draft;
 F_1, F_2, F_3 = forces acting on control volume of water;
 g = acceleration due to gravity;
 h = water-level depression (drawdown);
 k_1, k_2 = constraint factors;
 Q_w = flow discharge;
 s = slope of embankment;
 \bar{U} = average ambient velocity;
 u, v = velocity components;
 u', v' = fluctuating velocity components;
 \bar{u}, \bar{v} = time average velocity components;
 u_{rr} = average return velocity along flow direction;
 u_{cr} = critical velocity;
 u_r, v_r = return velocity components;
 u_s = vessel speed with respect to bank;
 u = vessel speed;
 W_l = lateral distance from vessel to bank;
 W_T = top width of river;
 α = correction factor; and
 ρ = density of water.

Distribution of turbulent velocity fluctuations in a natural river

Distribution des fluctuations de vitesse turbulente dans une rivière naturelle

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SUMMARY

Turbulent characteristics of flow velocity in a natural river were systematically analyzed in this study. Flow velocities were measured with time at six different lateral locations and at three different vertical elevations on a major navigable waterway in the United States. Analyses of the velocity data include the cross-sectional and vertical distributions of longitudinal and transverse velocity components (u , v), the fluctuating velocity components (u' , v') and their frequency-distribution curves, turbulent intensities (σ_u , σ_v), and turbulent shear stress ($-\rho \overline{u'v'}$). These analyses have shown that the strongest velocity fluctuation occurs near the main channel area above the river bed.

RÉSUMÉ

Cet article analyse systématiquement les caractéristiques turbulentes de la vitesse d'écoulement dans une rivière naturelle. Les vitesses d'écoulement ont été enregistrées en fonction du temps en 6 positions différentes sur la largeur et à trois profondeurs d'une des principales voies navigables des USA. Les analyses des mesures de vitesse comprennent les distributions horizontale et verticale des composantes longitudinale et transversale du vecteur vitesse (u , v), les composantes fluctuantes (u' , v'), leurs spectres de distribution d'énergie, leurs intensités turbulentes (σ_u , σ_v) et leurs contraintes de cisaillement turbulentes ($-\rho \overline{u'v'}$). Ces analyses ont montré que la plus importante fluctuation de vitesse est observée au voisinage du chenal principal à la verticale du lit de la rivière.

1 Introduction

When flow at a high Reynolds number moves between fixed boundaries, the longitudinal and transverse components of flow velocity, as well as the normal and tangential stresses, must be expected to fluctuate with time and space. Although these nonperiodic fluctuations are generally secondary in magnitude compared to the mean motion, they have profound effects on properties of the primary mean motion. Over the years several experimental studies have been performed using

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various techniques [10,11,12,13] in order to understand the mean flow and turbulent characteristics of open channel flow. Recently, the use of Laser Doppler Anemometers has also greatly advanced the investigation of turbulent structures in compound channels [7] and submerged hydraulic jumps [8]. However, turbulence and shear stresses in natural river systems are elusive subjects, and they have not yet been studied in great detail [1,2,3,5,6,15]. Scientists from the Illinois State Water Survey have been involved in collecting and analyzing detailed velocity data from a large river system using 2-D electromagnetic current meters. The goal of this research is to understand the turbulent velocity structure in natural river systems, especially near the channel border areas. An understanding of turbulence in natural rivers is important for the sediment transport, bank erosion, and evaluation of biological habitats as they relate to the physical and hydraulic characteristics of a river. The present investigation is aimed at presenting and identifying the temporal fluctuations of velocity components and turbulent shear stress for natural river flow. It addresses cross-sectional and vertical variations of velocity components (u, v), velocity fluctuation components (u', v'), turbulent intensities (σ_u, σ_v), and turbulent shear stress ($-\rho \overline{u'v'}$).

2 Equipment and data collection

A site-specific field study was conducted to investigate changes of velocity and turbulent shear stress in the Illinois River, a large natural river. Figure 1 shows a schematic diagram of the field set-up used in this investigation on the Illinois River at Kampsville, river mile (RM) 35.2. The x -axis is the longitudinal direction of river flow; y -axis is perpendicular to the sailing line, with the positive direction toward the left-hand side (LHS) of the river; and z -axis is normal to the xy -plane. The origin is set at the right-hand side (RHS) of the river. This study is part of a major research undertaking focusing on changes in hydrodynamic characteristics of the Upper Mississippi River System (UMRS) due to navigation traffic (the Illinois River is part of the UMRS). The present paper will concentrate on the turbulent characteristics of natural rivers without considering external disturbances such as the movement of navigation or recreational traffic.

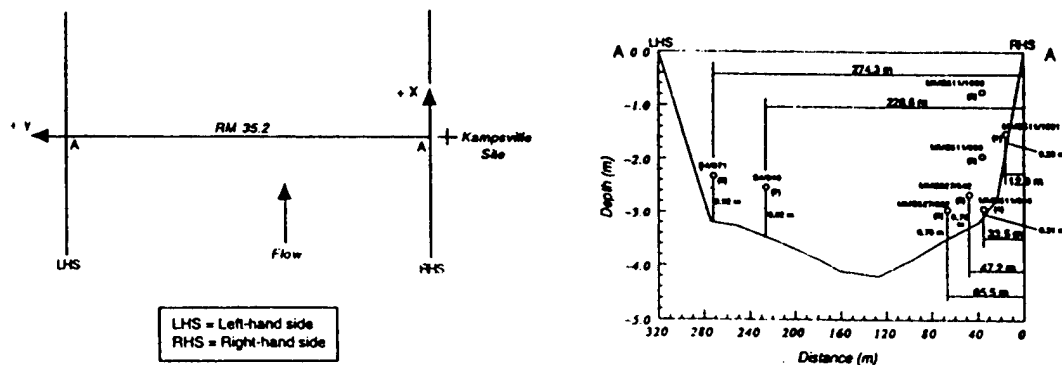


Fig. 1. Schematic diagram showing the data collection set-up on the Illinois River at Kampsville.

Velocity data were collected using eight 2-D electromagnetic current meters (six Marsh McBirney MMB511 and MMB527 meters and two Inter Ocean S4 meters). The relative locations of these meters are also shown in Figure 1. Current meters MMB511, MMB527, and S4 have spherical sensors of 3.9, 10.3, and 25.0 centimeters, respectively. All the meters have four probes and separate housings for electronics. The signal processing unit in each meter provides visual readings for the

x and y components of flow velocity. The accuracy and basic capabilities for these meters are presented in table 1. Figure 2 shows one MMB527 meter, along with a panoramic view of the field site.



Fig. 2a. MMB527 meter used in the field.

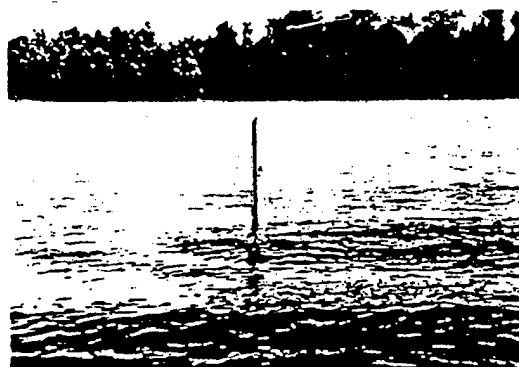


Fig. 2b. Panoramic view of the field set-up.

The x and y components of flow velocity (u , v) were continuously measured with time by two MMB511, two MMB527, and two S4 current meters at six lateral locations at distances of 12.9, 33.5, 47.2, 65.5, 228.6, and 274.3 meters (m) from the RHS of the river. The six meters were located at depths from 0.29 to 0.92 m above the river bed to measure the velocity fluctuation close to the bed in the cross-sectional direction. Three MMB511 current meters were also mounted at three vertical heights of 0.31, 1.22, and 2.44 m above the river bed, at a lateral distance of 33.5 m from the RHS. The three meters were used to detect the variations of velocity fluctuation in the vertical direction. To show real variations of flow velocity both in the lateral and vertical directions, the ideal approach would be to install a series of current meters (about 40 to 50) along a river cross section, and then draw isovels based on data measured. However, in the field conditions, this approach was not feasible because it required a substantial amount of money and personnel. In this study, velocity data were collected at the rate of one sample per second to study the turbulent velocity fluctuations.

Table 1. Meter specifications

Meter	Manufacturer	Parameters	Range	Accuracy
MMB527	Marsh McBirney	u, v direction	+300 cm/sec 0–360°	+2% of reading
MMB511	Marsh McBirney	u, v direction	+300 cm/sec	+2% of reading
S4	Inter Ocean	u, v direction depth temperature conductivity	0–350 cm/sec 0–360° 0–70 m –5–45°C 1–70 mS/cm	0.2 cm/sec 0.5° 4 mm 0.5°C 0.1 mS/cm

3 Analysis of velocity data

The longitudinal and transverse components of flow velocity (u, v), turbulent intensities (σ_u, σ_v), and turbulent shear stress ($-\overline{u'v'}$) were computed to better understand the turbulent velocity fluctuations in natural rivers. The velocity data were collected on three consecutive days (October 13 through 15, 1990). Four time slots were selected during which disturbances due to navigation or recreational traffic were absent:

Date	Time	Flow discharge, Q (m ³ /s)
October 13	1230–1330	732.5
October 14	1345–1445	758.6
October 15	1100–1200	771.7
October 15	1230–1330	776.0

The one-hour time interval was selected based on an evaluation of the turbulent velocity fluctuations (to be described later). The 60-minute duration essentially eliminates the variability due to short-term natural fluctuations in velocity within a river.

The temporal variations of longitudinal and lateral velocities and turbulent shear stress at any particular point in the river are of equal importance to those variations in space. The variation of velocities with time indicates acceleration, and the variation of turbulent shear stress with time indicates the transfer of momentum. These changes generate secondary currents and eddies. Denoting the instantaneous flow velocity into two parts, a time-averaged component and a fluctuating component, the relationships for the three velocity components (u, v, w) can be written:

$$u = \bar{u} + u'; \quad v = \bar{v} + v'; \quad w = \bar{w} + w' \quad (1)$$

The time-averaged component at a fixed point in space is given by:

$$\bar{A} = \frac{1}{T} \int_0^T A dt \quad (\bar{A} = \bar{u} \text{ or } \bar{v} \text{ or } \bar{w}) \quad (2)$$

where T must be a relatively longer time in comparison to the time scale of turbulence. Under the given time interval, T , the time-averaged value of the fluctuating component should be zero, i.e.:

$$\bar{A}' = \frac{1}{T} \int_0^T A' dt = 0 \quad (\bar{A}' = \bar{u}' \text{ or } \bar{v}' \text{ or } \bar{w}') \quad (3)$$

In order to determine the optimum time interval, T , the data collected during the four selected time slots were evaluated and tested. The values of u' and v' according to equation (3) were computed for each set of data for different time intervals. Figure 3 gives the results of the analysis of the data set for October 13, 1990, 1230 to 1330 hours. The time-averaged values of u' and v' normally stay high for time intervals of 5 to 20 minutes. After that, the values of \bar{u}' and \bar{v}' start to decrease asymptotically toward zero, and attain a value of about zero after 60 minutes. Similar variability and asymptotic natures were also observed for the other three time slots.

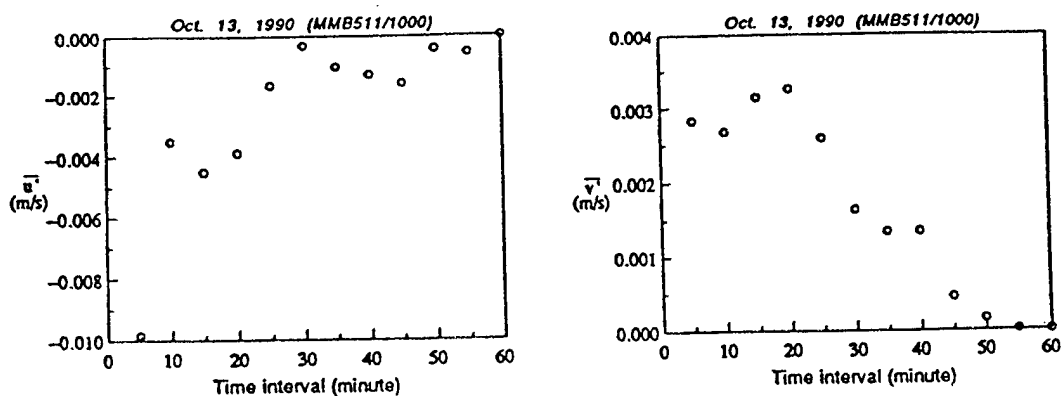


Fig. 3. Variations of \bar{u} and \bar{v} with time.

This analysis indicates that the 60-minute interval is probably quite appropriate for the determination of turbulent velocity fluctuations in large rivers such as the Illinois River.

Figure 4 shows the time series plots of flow velocity for the u and v components and their respective fluctuations, u' and v' , for a period of 60 minutes for the October 13 data set. A comparison of the magnitude of u with that of v shows that the transverse velocity component v is much less than the longitudinal velocity component u . These differences are approximately one order in magnitude. This is normally expected in open channel flow where the overall motion of the flow is in the direction of the longitudinal x -axis.

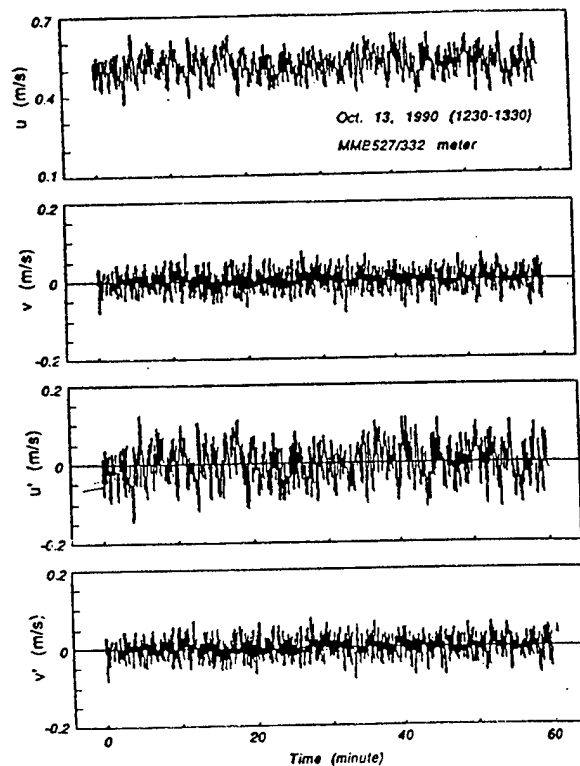


Fig. 4. Variations of measured u and v and u' and v' with time.

3.1 Cross-sectional and vertical velocity distributions

The longitudinal and transverse velocity components, each averaged over 60 minutes for four time slots on three consecutive days, have been plotted against the relative width (y/W) of the river in Figure 5, where y is the distance of each current meter from the RHS of the river and W is the cross-sectional top width of the river. This plot shows how the x and y components of time-averaged velocities change from one side of the river to the other and also with the flow discharge on each of the three days. The cross-sectional distribution of the time-averaged longitudinal velocity component, \bar{u} , which was measured from depths close to the river bed, shows that the maximum value of \bar{u} occurs near the sailing line of the river and that its value gradually decreases toward the shoreline. On the other hand, the lateral distribution for the time-averaged transverse velocity component, \bar{v} , is irregular, and its magnitudes are one order less than those of \bar{u} .

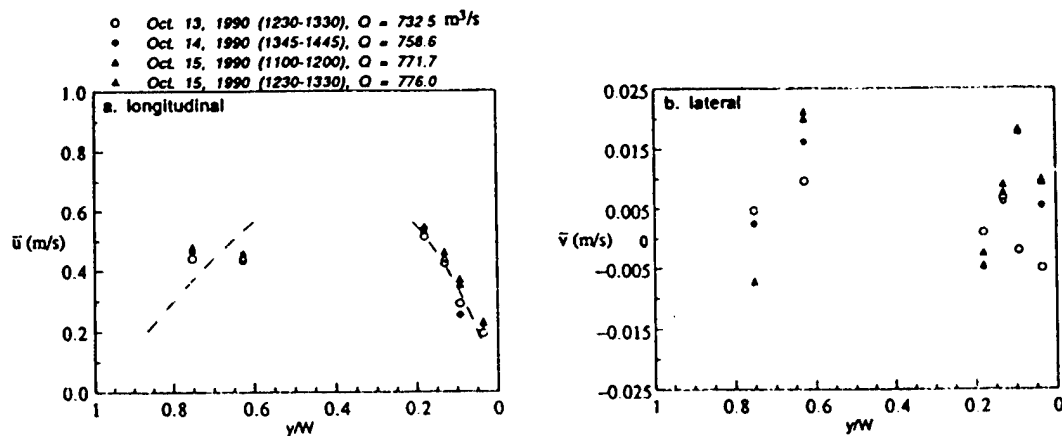


Fig. 5. Variations of time-averaged longitudinal and lateral velocities across the width of the river.

The river discharge for the three days varied from 732.5 cubic meters per second (m^3/s) to 776.0 m^3/s . However, the distribution pattern of \bar{u} for the four different discharges does not change appreciably, indicating the existence of a stable flow pattern at this site. On the contrary, the variation of \bar{v} with flow discharge seems more sensitive than that of \bar{u} . With increasing flow discharge, the variation in \bar{v} increases.

The vertical variations of the time-averaged velocity components, \bar{u} and \bar{v} , at a location of 33.5 m from the RHS of the river are shown in Figure 6 for the same three days and four time slots. The water depth at this location was 3.43 m, and the flow velocities were measured at heights of 0.31, 1.22, and 2.44 m above the river bed. This plot shows that the time-averaged longitudinal velocity component, \bar{u} , increases with depth toward surface. The distribution is approximately parabolic in nature. On the other hand, the magnitudes of the time-averaged transverse velocity component, \bar{v} , vary randomly with depth.

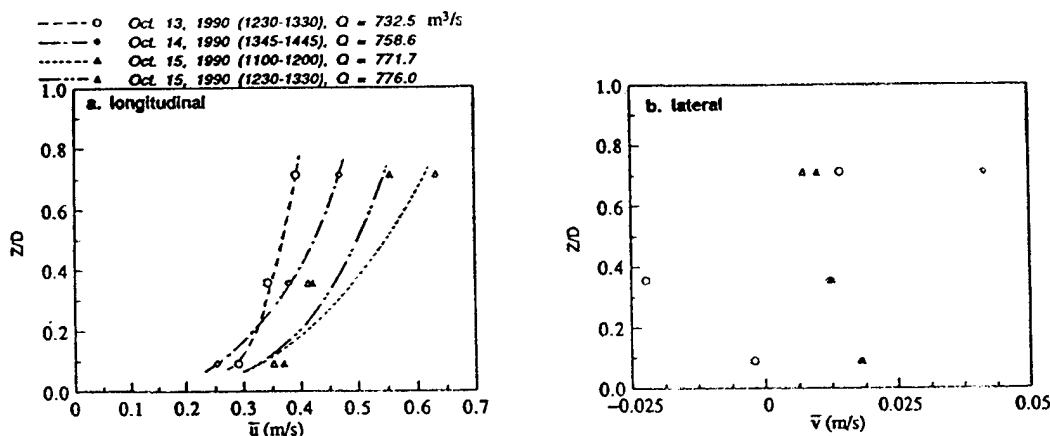


Fig. 6. Variations of time-averaged longitudinal and lateral velocities in the vertical direction.

3.2 Variability of turbulent fluctuations across river width

Fluctuations of flow velocity at any fixed location can be studied by developing a frequency-distribution curve of the differences between the instantaneous velocity and the mean velocity [14]. Since velocity data were collected at a rate of one sample per second and a 60-minute time interval was selected for the study of turbulent velocity fluctuations, there were a total of 3600 measurements for each 60-minute time slot. These 3600 data points were used to develop frequency-distribution curves for both u' and v' . Here, the frequency is defined as the number of occurrences of a certain value of u' or v' in 3600 measurements. This analysis, when applied to each measured point in a river cross section, can depict the strong or weak turbulent fluctuations of the flow velocity at different lateral and vertical locations.

Figure 7 shows such a set of frequency-distribution curves for the longitudinal velocity fluctuation, u' , across the width of the river (RM 35.2) at six locations and over the depth at three elevations (see Figure 1) for the October 13 data set. When the measured values of u' ($u' = u - \bar{u}$) are small, their frequency distribution is clustered close to zero on the x-axis, indicating that the fluctuation is weak. Conversely, when the measured values of u' are large, their frequency distribution will spread out, indicating a strong fluctuation. Thus, Figure 7 indicates that the velocity fluctuation is relatively weak near the shoreline and quite strong near the main channel area of the river.

Figure 8 shows the variability of the frequency-distribution curves for the lateral velocity fluctuation, v' , for the same eight points used in Figure 7. The distributions of these frequency plots are similar to those shown in Figure 7 for u' . The lateral velocity fluctuation is also quite small near the channel border areas compared to that near the main channel area. Thus, both Figures 7 and 8 indicate that turbulence is strong in the main channel near the river bottom and quite weak near the channel border areas.

Statistical parameters associated with these frequency-distribution curves are given in table 2 for the longitudinal and lateral velocity fluctuations, u' and v' , across the width of the river and in the vertical direction, respectively. These statistical parameters indicate that the velocity fluctuations can be fitted by a normal (Gaussian) distribution and that the selection of the 60-minute time interval is correct since the mean values of u' and v' are almost equal to zero.

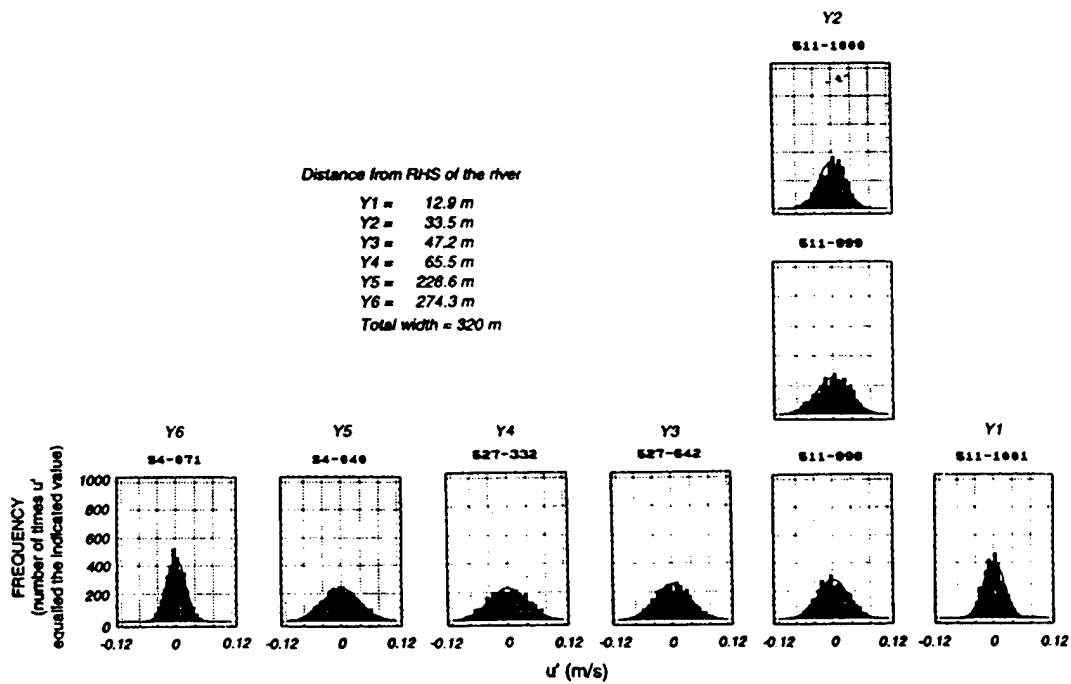


Fig. 7. Frequency distribution of longitudinal turbulent velocity fluctuation, u' , in the river cross section

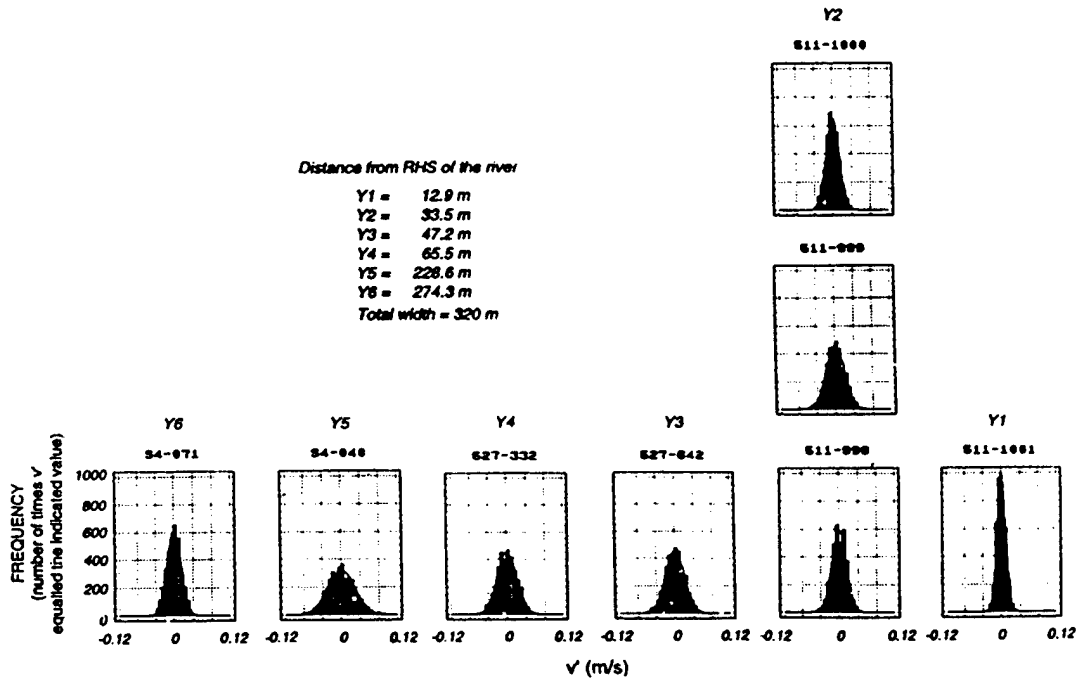


Fig. 8. Frequency distribution of lateral turbulent velocity fluctuation, v' , in the river cross section.

Table 2. Statistical parameters for u' and v'
(a) Transverse direction

Statistical parameters		Meter number					
		S4/071	S4/040	MMB527/332	MMB527/642	MMB511/998	MMB511/1001
u'	mean	6E-07	9E-07	5E-07	3E-07	-1E-07	7E-07
	stand. dev.	0.021	0.041	0.042	0.038	0.034	0.023
	range	0.151	0.262	0.266	0.229	0.235	0.164
	skewness	0.09	0.11	-0.08	0.03	0.08	0.57
v'	mean	2E-08	2E-07	2E-07	4E-07	-8E-06	-2E-06
	stand. dev.	0.016	0.029	0.021	0.021	0.016	0.010
	range	0.110	0.293	0.156	0.148	0.124	0.069
	skewness	-0.12	0.11	-0.07	-0.09	-0.17	0.07

(b) Vertical direction

Statistical parameters		Meter number		
		MMB511/998	MMB511/999	MMB511/1000
u'	mean	-1E-07	6E-07	3E-07
	stand. dev.	0.034	0.037	0.028
	range	0.235	0.240	0.177
	skewness	0.08	-0.15	-0.34
v'	mean	-8E-06	-6E-06	6E-08
	stand. dev.	0.016	0.020	0.014
	range	0.124	0.156	0.104
	skewness	-0.17	-0.14	0.04

3.3 Turbulent intensity

The turbulent intensity or variance in the x -direction can be defined by the root-mean-square value of the x component u' as:

$$\sigma_x = \sqrt{u'^2} = \left[\frac{1}{T} \int_0^T u'^2 dt \right]^{1/2} \quad (4)$$

A similar expression can be written for the y component, σ_y .

The cross-sectional variations of turbulent intensity for both the longitudinal and lateral velocity fluctuation components (σ_x , σ_y) for the three days and four time slots are shown in Figure 9. Again, these values of σ_x and σ_y were averaged over 60 minutes. Figure 9 indicates that the maximum

magnitude of σ_x or σ_y occurs in the main channel area and that their magnitudes decrease gradually toward the channel border areas. The qualitative behaviors of the distributions of longitudinal and transverse turbulent intensities across the width of the river are similar, except that the magnitude of σ_y at any location is about 50 to 70 percent of σ_x .

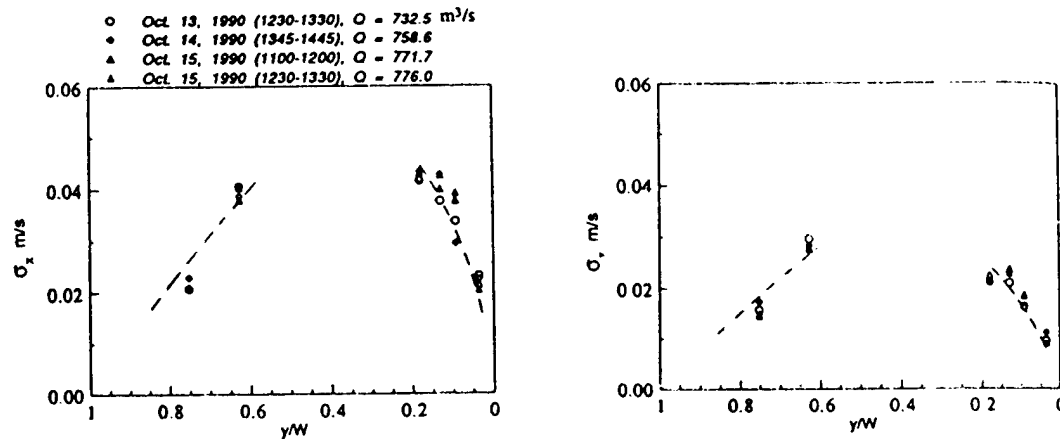


Fig. 9. Variabilities of turbulent intensities, σ_x and σ_y , across the width of the river

The variability of σ_x across the width of the river is almost identical to that observed for u (see Figure 5). The similarity of the cross-sectional variability of u and σ_x also indicates that the flow, on average, is fairly stable at this reach.

Figure 10 shows the change in the values of σ_x and σ_y in the vertical direction for the same four time slots. In general, turbulent intensity increases from the surface toward the bottom, with a sharp increase at an elevation of 10 to 20 percent of the depth from the bed; then it decreases asymptotically closer to the bed. As expected, Figure 10 shows that turbulent intensity is likely highest at an elevation of 10 to 20 percent of the depth from the river bed.

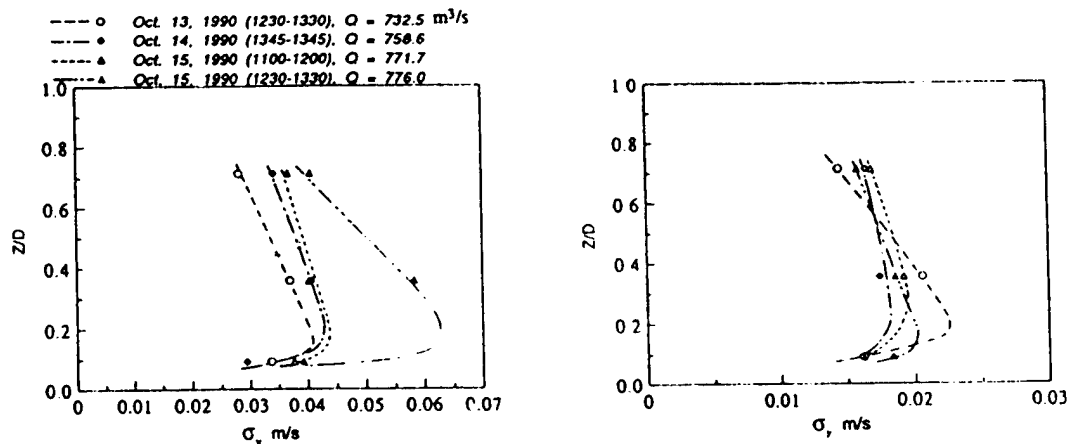


Fig. 10. Variabilities of turbulent intensities σ_x and σ_y in the vertical direction

3.4 Turbulent shear stress

For two-dimensional turbulent flow, turbulent shear stress or Reynolds stress is defined as:

$$\tau_{xy} = -\rho \overline{u'v'} = -\frac{\rho}{T} \int_t^{t+T} u'v' dt \quad (5)$$

which can be interpreted as the transport of x -momentum through a surface normal to the y -axis [4,9]. Data collected from this research were used to compute the instantaneous turbulent shear stress, $-\rho u'v'$. Figure 11 shows the variations of $-\rho u'v'$ with time at six locations across the width of the river (see Figure 1) for the October 13, 1990, data set. This Figure illustrates that the magnitudes of $-\rho u'v'$ are relatively small near the river bank in the channel border areas compared to those measured far from the bank. Similar results were also observed for other flow discharge conditions.

The cross-sectional variation of the time-averaged turbulent shear stress, $-\overline{\rho u'v'}$, for four time slots on the three days, has been plotted in Figure 12(a) against the relative width of the river. Note that the absolute magnitude of $-\overline{\rho u'v'}$ decreases toward the shoreline, which indicates that the transfer of the x component of the momentum normal to the y -axis is higher in the area away from the river bank. Also note that the turbulent shear stress in Figure 12(a) has different signs in the left and right halves of the river and must go through zero somewhere in the middle of the river where the time-averaged longitudinal velocity component, \bar{u} , has a maximum magnitude and hence zero gradient. Since it is impossible to gather velocity data from the central part of the river due to heavy commercial navigation traffic, Figure 12(a) could not display this location for the zero turbulent shear stress; however, it is certain to occur at this location.

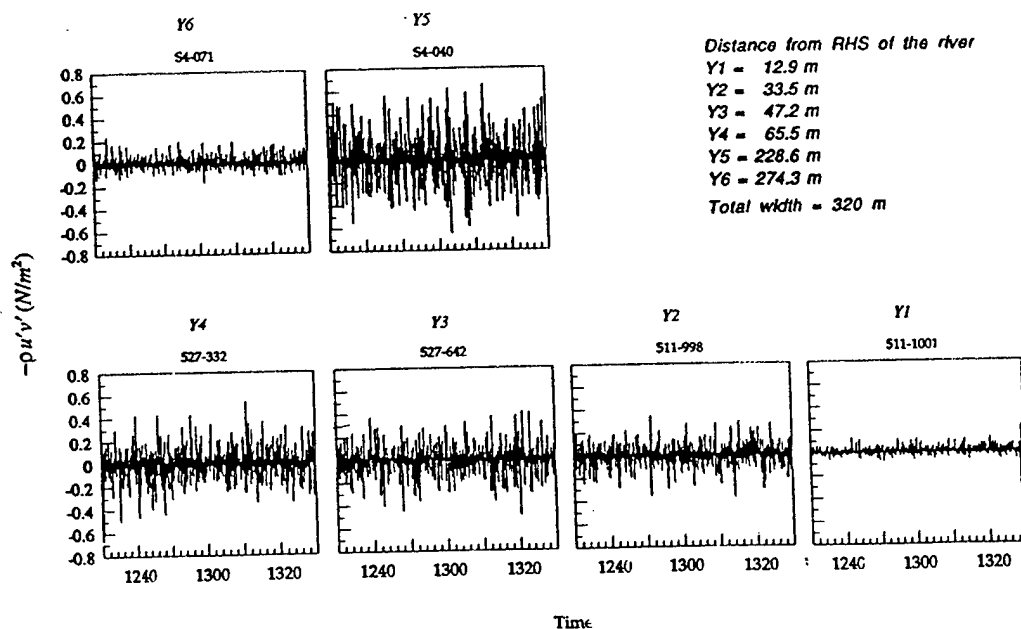


Fig. 11. Variation of instantaneous turbulent shear stresses with time for October 13, 1990 from 1230 to 1330 h.

Figure 12(b) shows the vertical variation of the time-averaged turbulent shear stress. This Figure shows that the maximum turbulent shear stress also occurs at an elevation of about 10 to 20 percent of the depth from the river bed with an associated decrease in the vertical direction. This variability is also similar to that observed for σ_x and σ_y .

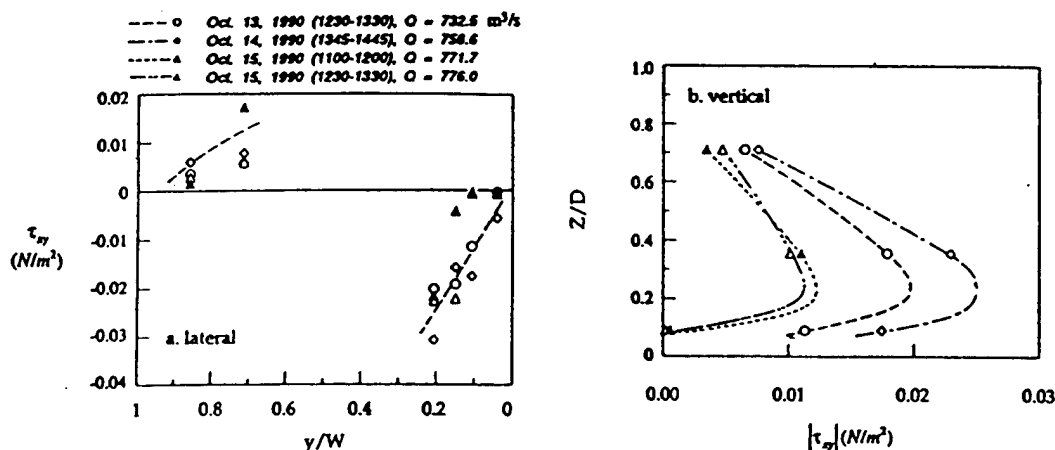


Fig. 12. Variability of turbulent shear stresses across the width of the river and in the vertical direction.

4 Conclusions

Turbulent fluctuations of flow velocities in a natural river were investigated to understand the turbulence characteristics of large rivers. The investigation included the distributions of turbulent velocity fluctuations near the bank and bed of the river. The analyses presented for u , v , σ_x , σ_y , and τ_{xy} have significant implications for the evaluation of biotic habitats in large river environments. It appears that the velocity, velocity fluctuation, turbulent intensity, and turbulent shear stress are all relatively high toward the main channel area. Moreover, all of these flow parameters decrease toward the channel border areas. Therefore, the main channel area above the river bed is the most active zone as far as turbulence is concerned. These observations are important in understanding the creation of turbulent eddies, sediment transport processes, and bank erosion mechanisms. It should also be noted that the values of σ_x , σ_y , and τ_{xy} were found to be high at elevations of 10 to 20 percent of the depth above the bed. Thus, any external disturbance that may increase or alter these natural conditions could affect the natural aquatic habitats existing at those locations during normal conditions.

5 Acknowledgements

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Notations

t	Time
T	Time interval
u, v, w	Velocity components
u', v', w'	Fluctuating velocity components
$\overline{u}, \overline{v}, \overline{w}$	Time-averaged velocity components
$-\rho \overline{u'v'}$	Turbulent shear stress
x	Longitudinal coordinate
y	Lateral coordinate
z	Vertical coordinate
σ_x, σ_y	Turbulent intensities
τ_{xy}	Turbulent shear stress

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APPENDIX XXXII.

**LIST OF RELEVANT TECHNICAL REPORTS AND PRESENTATIONS
PREPARED BY WATER SURVEY RESEARCHERS**

Technical Reports and Presentations
Prepared by Illinois State Water Survey Researchers

- Adams, J.R. 1991 *Identification of Study Approaches to Determine Physical Impacts of Commercial Navigation on the Upper Mississippi River System*. Illinois State Water Survey Contract Report 531.
- Adams, J.R. 1992. *Bed Characteristics of the Mississippi River within Pool 19*. Illinois State Water Survey Contract Report 535. Also reprinted by Long Term Resources Monitoring Program. Jan. 1993. Reprint 93-R006.
- Adams, J.R. 1992. *Sediment Concentration Changes caused by Barge Tows*. Proceedings of Water Forum '92, Hydraulics Division, ASCE, Baltimore, MD, August 2 to 5.
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- Bhowmik, N.G. 1991. *Hydraulic Changes in Rivers due to Navigation*. Proceedings of the Fifth Federal Interagency Sedimentation Conference, Las Vegas, NV, March 18-21, pp. 10-33 - 10-40.

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